

NASA Aerospace Education Services Project
Administered by Pennsylvania State University
Cooperative Agreement Number NNX07AQ96A
Cecelia Fletcher, AESP Project Manager
Langley Research Center
757-864-2339

PROJECT DESCRIPTION

Utilizing NASA content, the Aerospace Education Services Project (AESP) provides formal and informal educator professional development (PD) to the elementary and secondary education community including: in-service training for educators, pre-service training for university students, training for informal educators, distance learning events, and identification of appropriate NASA education resources, from all of NASA's extensive portfolio of products, for formal or informal learning. Based upon research-supported best practices, AESP efforts are targeted at providing long-duration PD to educators. Long-duration PD consists of direct educator interactions greater than two days in duration. AESP also motivates students to continue their study of science and mathematics throughout their school experience by providing NASA products to educators and students. Through utilization of NASA materials, students better understand how STEM content is relevant to them. Because educators are better able to use engaging, real-world material in their classrooms, students become more familiar with STEM career possibilities related to NASA as well as STEM careers in general.

AESP is responsible for:

- Assisting STEM educators in understanding how to incorporate NASA's research and education portfolio into their curriculum, aligning content with core standards and 21st Century Skills, as well as, developing engaging, innovative, and research-based learning activities.
- Establishing and supporting the NASA Educators Online Network (NEON) for the education and STEM communities creating synergy among STEM educators and NASA scientists and engineers across the nation. NEON is an online learning community for educators, scientists and engineers that provides opportunities for PD and training grounded in education research while also reflecting current and future NASA science and exploration missions.
- Helping educators join and participate in online communities for personal PD through webshops, NEON and other online resources. AESP specialists help participants acclimate to on-line technology enabling educators to experience a cohort of collegial support through these avenues. Such endeavors result in NASA advocates in the education community.

AESP staff consists of Education Specialists who are experienced STEM teachers, with NASA expertise, located at NASA's 10 Field Centers. AESP provides customized and unique PD programs for educators in all 50 states and US territories that are aligned to local, state and national standards which lead to high quality STEM training and sustainability. This includes modeling best practices from the 21st Century Skills.

AESP is managed out of NASA Langley Research Center and implemented by The College of Education at Pennsylvania State University (PSU) under a cooperative agreement that was awarded in 2007. PSU hires and supervises the Education Specialists who cover all of the 50 states and territories. In addition, PSU implements and manages the NEON website for use by all of NASA Education.

PROJECT GOALS

In order to more effectively support the NASA Strategic Plan and the Office of Education performance metrics, AESP focuses its efforts on the following goals:

- Expand teachers' pedagogical content knowledge in STEM-related areas through a variety of PD venues, focusing extensively on the use of technology for delivery.
- Work closely with higher education to strengthen pre-service and in-service teacher education at colleges and universities where NASA R&D is conducted.
- Shift the focus of Education Specialist interactions with educators from one-time visits and school assemblies to efforts that strengthen educator PD by striving for long-duration PD sessions.
- Participate strategically in conferences such as state and regional science teachers' meetings as funding permits in order to help bring NASA STEM to teachers and to maintain contacts with state education leaders.
- Work early with new NASA projects that are planning K-12 components, to contribute ground-truth perspective on the actual needs of teachers, state curriculum standards, and mechanisms for training and dissemination.
- Update and organize educational materials as appropriate to meet evolving national STEM standards and refocus the materials to incorporate inquiry, engineering design problem-based learning, mission-based learning, team-work, and other pedagogically sound and research supported practices.
- Facilitate collaborations between K-12 schools and university and industry-based scientists and engineers.
- Utilize technologies to reduce distance, deliver customized solutions, and support collaboration.

PROJECT BENEFIT TO STRATEGIC GOAL 6 AND OUTCOME 2

All AESP activities are designed to support NASA's Strategic Plan and the Office of Education's Strategic Goals and Outcomes. The goals of AESP aligns to Strategic Goal 6 to "Share NASA with the public, educators, and students to provide opportunities to participate in the NASA Mission, foster innovation, and contribute to a strong national economy" and to Outcome 2 to "attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty". Specifically, AESP provides educators nationwide with knowledge and tools with which to inspire students in STEM utilizing PD experiences and materials that align to needs and opportunities identified by districts, states, Department of Education, professional organization and other stakeholders. AESP also provides elementary and secondary students with authentic NASA mission-based opportunities that build STEM knowledge, skills and career awareness:

- AESP provides educators and students with NASA-related STEM tools, experiences and opportunities to further their education through educator workshops and online resources. AESP provides authentic NASA hands-on activities based on NASA missions. For example, many activities from the Human Exploration and Operations Mission Directorate's popular Rocket Educator Guide are frequently used. Education Specialists are committed to ensuring that the educator professional development (PD) material and experiences provided support the educator's needs and align with core standards. AESP supports numerous informal education programs and activities at science centers, museums, and related facilities.
- In FY2012, 6,384 educators participated in long duration AESP STEM PD opportunities, and 26,107 participated in PD opportunities of a short duration. In total, 28,774 educators were

reached by AESP at least once in FY12 with a total of 32,491 separate contacts. A 120-day follow-up survey of a sample of teacher participants indicates that, among those who participated in AESP STEM PD, approximately 96% subsequently used NASA resources in their classroom.

- AESP offers student programs in support of PD efforts to engage and retain students in STEM education and encourages them to pursue educational disciplines that are critical to NASA's future engineering, scientific and technical missions. Through AESP, 47,537 students participated in NASA instruction and enrichment activities in FY 12.

PROJECT ACCOMPLISHMENTS

- Over 76,300 students and educators were reached either through STEM-related student activities or STEM educator PD in FY 2012. Listed below is additional information concerning the AESP interactions with students and teachers:
 - Over 47,000 students and 28,000 teachers were reached by AESP. Of these numbers, ~21,000 were middle school students and ~11,000 were middle school teachers.
 - AESP educational specialists reached 23,223 certified teachers, 3,027 informal educators, and 2,991 pre-service teachers through PD workshops and activities. In addition, another 630 educators, 1,955 engineers and scientists, and 39,272 members of the public – including over 16,000 parents and guardians - were involved in AESP activities conducted this year.
 - 5,528 educators were engaged in long-duration PD, a 9% increase in long-duration PD over FY 11, and 76% more than were engaged in FY10.
 - Short duration PD was delivered to 23,079 educators, primarily as recruitment for long duration PD. This was a 1.5% increase over short duration PD participants in FY 2011.
 - AESP provided over 66,700 quality NASA STEM curricular support resources and materials to educators, students, administrators, faculty and parents/guardians.
 - More than 650 workshops and site visits were conducted by AESP personnel in FY 2012 to support educators who served predominantly underrepresented and underserved student populations.
- In June of 2010, AESP deployed the NASA Educator Online Network (NEON), (<http://neon.psu.edu>), a web-based peer-to-peer educator PD site that has experienced tremendous growth. NEON's goal is "to create a large, vibrant online community of educators, scientists, and engineers that engage in projects designed to improve teaching and learning."
 - As of September 30, 2012, NEON membership was 6,084, a 28% increase over FY 11, with a membership of 4,694 certified teachers, 998 other educators, 193 scientists and engineers, and 151 NASA staff members.
 - As planned, NEON has become NASA education infrastructure. There were a total of 246 groups on NEON at the end of FY 2012, 45 were NASA education groups that derived from NASA education projects and one mission directorate. The core NASA Education groups on NEON are: Aerospace Education Services Project, Central Operation of Resources for Educators (CORE)/Educator Resource Center Network (ERCN), Interdisciplinary National Science Program Incorporating Research and Education Experience (INSPIRE), Learning Environment and Research Network (LEARN), NASA Explorer Schools (NES), Summer of Innovation (SoI), Space Grant, and Pre-Service Teacher Institutes (PSTI), and Teaching From Space (TFS).

- A “NEON Resource Repository” was developed to allow NEON members to share non-copyrighted resources and became operational in June 2011. As of the end of FY 2012, 365 lesson plans, videos, and other resources had been posted in the Resource Repository.
 - The NEON “brand” was also used to promote an open enrollment webinar series, a Facebook page, and online “office hours” that allow teachers to chat, talk, or video chat with Education Specialists to help find and use NASA resources.
 - A literature review on online learning communities and the role of NEON in advancing a learning community of educators was performed by PSU in FY 2012 identifying strengths and weakness of online interactions as found in the research base and outlining AESP’s experiences in providing PD through this approach.
- AESP provided HQ-requested support for several important events in FY 2012 including the roll-outs of Shuttles Enterprise and Discovery at the Udvar-Hazy Center at the National Air and Space Museum and the Intrepid Sea, Air, and Space Museum, respectively, as well as, the Transit of Venus, International Observe the Moon Night, Sun-Earth Day and others. In addition, AESP promoted events and opportunities from across NASA Office of Education and Mission Directorates. For example, at the request of the National Science Teachers Association (NSTA), AESP coordinated and hosted the NASA participation at the NSTA national conference in March 2012.
- In April 2011, "Joining Forces," a national initiative to support and honor America’s military service members and their families was launched by the White House. AESP conducted numerous events in FY 12 in support of the military and their families. Examples of these events follow: AESP Education Specialists traveled to Ansbach Germany to provide training on NASA education products and lesson activities to educators from all U.S. Army Garrisons in Europe in support of after-school programs for students in grades K-12 as part of the DODEA Bavarian Garrison “Space Science Week for After School Educators Discovery Program”. In addition to the face-to-face activities that AESP conducted in support of the military, AESP Education Specialists also conducted virtual careers workshops including “Operation: Military Kids” for children of deployed parents in various South Carolina cities reaching ~430 military children and 65 of their teachers.
- AESP provides educator PD “tie-in” workshops that coincide with the Exploration Experience trailer visits across the country as part of the work it conducts under the Workshops Helping Educators Explore and Leverage STEM (WHEELS) program. WHEELS is a Human Exploration and Operations Mission Directorate (HEOMD)-funded project. In FY12, 16 WHEELS events were supported and 458 in-service teachers, pre-service teachers, and other educators received instruction using HEO-developed materials in the classroom. Five hundred eighty-one K-12 students and 143 adults also participated in these events.
- AESP also provides curricular development and PD services to Summer of Innovation (SoI). Overall, AESP touched 1,005 in-service and pre-service educators, as well as, 605 informal educators in support of the SoI national partners during FY 12 with more than 2,900 separate contacts occurring to deliver NASA content. AESP Curriculum Specialists also developed SoI mini-themed camps in FY 12. These curriculum “packets” of activities and lessons are for use in SoI camps to help educators better design and implement student summer experiences. Please read the SoI annual report for further details on SoI.

- Prior year funding, from the Aeronautics Research Mission Directorate (ARMD) and Office of Education, supported the development of an open education resource for high school teachers on modeling and simulation practices in science and engineering. The new FlexBook, entitled Modeling and Simulation for High School Teachers: Principles, Problems, and Lesson Plans, was released in August 2012. In conjunction with the release of the Flexbook, a ceremony to recognize the Flexbook contributors was held in DC. Speakers at the recognition ceremony included the Deputy Director of Policy for the Office of Science and Technology Policy, the Center Director for the NASA Langley Research Center, and the Deputy Associate Administrator for Integration in NASA Headquarter's Office of Education. Six AESP staff were recognized during the ceremony for their contributions to the development of the Flexbook. FlexBook, is a trademark of the CK-12 Foundation. CK-12 stands for “Content K-12.” CK-12 is a non-profit organization that develops free online, educational textbooks. In July of 2011, NASA signed a Space Act Agreement (SAA) with the CK-12 Foundation to develop the Modeling and Simulation FlexBook.
- AESP specialists have updated many of their workshops and prepared them for delivery via virtual and online technologies. Long duration PD is more easily sustained through the use of these methods of delivery. Specialists conducted 228 online events (via Skype, Adobe Connect, WebEx and the Digital Learning Network) as part of their FY 2012 efforts—more than 4 times the number of online events in FY 11. Using these forms of distance technology, 2,739 educators and 2,508 students (a subset of the numbers listed above) were reached. An additional 758 educators were reached via online services as part of the Summer of Innovation work.
- AESP Education and Curriculum Specialists’ expertise in STEM education was acknowledged through invitations to work with organizations throughout the country, including advisory support to/participation in: NSTA Aerospace Advisory Committee, Governor’s STEM Advisory Board for Massachusetts, Indiana STEM Taskforce and Indiana Afterschool network; Committee to develop an Environmental Literacy plan for the state of Texas; Texas Citizens for Science group; Coordinating Committee for Iowa Department of Education Real World Design; Board of Directors for Puerto Rico Science Teachers Association; Oregon and Idaho Space Grant Consortiums; and Advisory Board of Kentucky Girls STEM Collaborative.
- AESP continued to provide Race to the Top (RTTT) support in FY 2012. Examples of support include: worked with the Georgia Tech Center for Education Integrating Science, Mathematics, and Computing (CEISMC); conducted a workshop for the Ohio Battelle Conference under RTTT; conducted summer in-service workshops for teachers held at Middle Tennessee State University; and participated as a member on the STEM Council of Massachusetts acting as a NASA resource person to the state on STEM issues in education.
- In FY12, AESP Specialists attended 80 conferences. National conference participation included NSTA, 21st Century Community Learning Center, the International Society for Technology in Education, the National Council of Teachers of Mathematics, the Space Exploration Educators Conference, along with many state and regional conferences in STEM education.
- Numerous AESP employees received prestigious recognition in FY 2012 including the following NASA honors: “Exceptional Public Achievement Medal” and NASA “Group Achievement” awards for contributions to NASA Education and the Flexbook, the “Power of One” silver award from Johnson Space Center and the NASA Goddard Space Flight Center (GSFC) “Code 100 Peer Award” for outstanding customer service. In addition to NASA awards, the AESP Financial Assistant at PSU received the “2012 Outstanding Staff Award” from the PSU College of

Education and an AESP Education Specialist was commissioned by the Governor of Kentucky as a “Kentucky Colonel in the Honorable Order of Kentucky Colonels.”

- The PSU Director of AESP continues to work with the Innovative Partnership Program at the GSFC on their SAA with Tor/Forge books signed in July 2011 to write a series of “NASA-inspired science fiction” novel with help from NASA in understanding how the agency does its work. In October 2011, the Director participated in a two-day NASA orientation session at GSFC attended by a number of New York Times bestselling authors. AESP is working with the program both because it initiated the relationship with Tor/Forge and because both NASA and Tor/Forge want to use the completed works for education purposes.

PROJECT CONTRIBUTIONS TO ANNUAL PERFORMANCE GOALS

Annual Performance Goal 6.1.1.1, ED-12-3: 35,000 educators participate in NASA education programs.

28,773 teachers, both in-service and pre-service, along with informal educators participated in AESP PD opportunities in FY 2012.

Annual Performance Goal 6.1.2.2, ED-12-5: 200,000 elementary and secondary students participate in NASA instructional and enrichment activities.

AESP provided NASA experiences that inspired **47,537** elementary and secondary students’ interest in STEM disciplines in FY 2012. Of the total students reached, **21,353** were middle school students.

Annual Performance Goal 6.2.1.1, ED-12-7: 50% of educators use NASA resources in their curricula after participating in NASA professional development.

556 educators reached by AESP responded to the **short duration** follow-on survey. Of that number, **96%** of the educators had used the NASA materials in their classrooms following AESP-sponsored activities according to the Office of Education Performance Measurement (OEPM) system.

28 educators reached by AESP responded to the **long duration** follow-on survey. Of that number **100%** of the educators had used the NASA materials in their classrooms following AESP-sponsored activities according to the OEPM system.

IMPROVEMENTS

Collaborations:

- AESP’s successful competitive award from HEO WHEELS was renewed for a 4th year, which demonstrates AESP’s ability to leverage other resources, and, in turn enable other projects to take advantage of AESP to deliver services nationwide.
- AESP received significant funding from the SoI project for on-line curriculum development support and PD support of national awardees in FY 2012.
- The Aeronautics Research Mission Directorate (ARMD) and Office of the Chief Technologist (OCT) provided funding to AESP in FY 12 for curriculum development support. AESP will be working to update ARMD activities to align them with national standards, make more current NASA connections, and make the activities work on their own rather than as part of a larger unit

so that teachers can better customize them to their own classroom needs. Project staff will also develop new K-12 lessons plans for OCT in the area of Technology Demonstration Missions.

- The following NASA projects have utilized the NEON community to enhance their programs: NASA Explorer Schools (NES), the NASA electronic PD Network, NASA Network of Educator Astronaut Teachers (NEAT), NASA EDGE, NASA Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPIRE), and NASA Educator Resource Centers.

Efficiencies:

- AESP has created a NASA AESP PD Alliance, composed of organizations such as, colleges, universities, science museums, science centers and Space Grant consortiums throughout the US and Puerto Rico that have worked with AESP in the past to deliver exceptional NASA teacher PD. The purpose of the Alliance is to better communicate opportunities and information between NASA Education and STEM PD providers. AESP Education Specialists work with a point of contact at each participating organization to develop a strategic plan for delivering NASA PD to teachers in their area either with AESP or other NASA Educators.
- Training has been implemented to help AESP Education Specialists develop expertise in online PD delivery, ensuring high quality interactions with educators.

Diversity:

- AESP employees provided Language Assistance Services for NASA Conducted Programs and Activities in FY 2012 as follows:
 - In Puerto Rico, Education Specialists translated SoI PowerPoint slides and facilitated the Puerto Rico teachers in the development of lesson plans with translated SoI content.
 - AESP employees continued to support Univision events where it was required that the Education Specialist be bi-lingual due to the participation of Spanish-speaking families in the event.
- NASA strives to ensure that underrepresented and underserved students participate in NASA education programs to encourage more of these students to pursue STEM careers. AESP is committed to serving all communities with special focus on underserved/underrepresented students and institutions. AESP serves very large numbers of schools in rural communities and schools in districts with a majority of students from low-income households.

The FY 2012 diversity performance metrics are as follows: AESP conducted 492 events, interacting with 15,638 educators and 20,480 students that were identified as predominantly underrepresented or underserved. As a result, it is estimated that 48% of all educators served by AESP in FY2012 taught disadvantaged student populations and that 43% of the students who participated in AESP events also came from these same populations.

The FY2012 diversity accomplishments are detailed below:

- A total of 81 events – 44 onsite educator workshops, 15 onsite student workshops, 13 pre-service educator workshops, and 9 informal & community outreach events – were held in rural locations in FY2012—an increase by approximately 10% over FY 11.

- Twelve events were held this past year at Historically Black Colleges and Universities, or at NASA centers which hosted students from those institutions for workshops—this equates to more than double the AESP events at HBCU’s in FY 11. A total of 310 educators, including 153 pre-service teachers, participated in these events.
 - Seventeen events were held this past year at Hispanic Serving Institutions (HSI’s), the first year AESP tracked events at HSI’s. A total of 471 educators, including 110 pre-service teachers, participated in these events.
 - Seventy-seven events – 62 educator workshops, 14 student workshops, and 1 pre-service workshop – were also held at sites that served predominantly Hispanic populations. This is a 64% increase over FY2011. A total of 1,632 educators received services as did 2,108 K-12 students.
- In FY 2013 AESP will continue to strive to improve its diversity accomplishments by working to facilitate additional online PD opportunities with educators who serve disadvantaged populations.

Project Management:

- A new deputy project manager from NASA’s Stennis Space Center joined AESP in late summer of 2012 and is already making significant contributions to the team.

PROJECT PARTNERS

- In FY 2012 AESP developed a new collaboration with Teach for America (TFA) to provide educator PD to its staff. TFA and NASA are 100Kin10 partners. AESP conducted 7 sessions for TFA corps members in the states of South Dakota, Texas and the District of Columbia. A total of 147 teachers, including 62 middle school teachers, participated in workshops with instruction on NASA content, pedagogy, rocketry, the electromagnetic spectrum, and conducting inquiry-based science lessons. TFA regions continue to express enthusiasm for the NASA AESP-provided STEM PD and more regions are in the process of scheduling sessions.
- In addition, AESP had several discussions during FY12 with NSTA on possible collaborations. One of the new collaborative efforts has been Teacher Learning Journeys (TLJ). The TLJ approach is designed to support individualized, independent teacher professional development in an on-line setting, using a travel metaphor. PSU worked with NSTA for about six months, developing the prototype and adding learning resources. The TLJ system provides recognition in the form of stamps (for relatively simple accomplishments) and badges (reserved for activities requiring greater effort and more likely to improve student learning), and feedback for educators’ professional development accomplishments. A pilot of the system began in mid-June. The pilot offered 55 NASA and NSTA activities among three subject areas: weather & climate, engineering, and solar system. During the pilot, thirty-six unique educators collected 133 stamps and 21 badges, an average of 4.2 awards per participant. These activities resulted in a self-reported total of 335 hours of professional development work, an average 13.4 hours of time teachers willingly devoted to their professional growth. Feedback received on the pilot has been positive and will help inform design changes and updates that will be implemented in fall of 2012. NSTA and AESP have also met with representatives of several universities to make plans to expand the content and extend the TLJ model into the future.