

**Statement of  
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before the**

**Subcommittee on Research and Science Education  
Committee on Science and Technology  
U.S House of Representatives**

Chairman Baird and Members of the Subcommittee, thank you for the opportunity to appear before the Subcommittee today to discuss NASA activities that support K-16 science, technology, engineering, and mathematics (STEM) educational programs.

NASA recognizes the important role education plays in developing the diverse scientific and technological workforce required to advance this Nation's economic leadership. The United States has a tremendous need to build, sustain, and deploy the skilled talent that will be required to continue America's pre-eminence in space and aeronautics research and development in the coming decades. NASA serves as a contributor for achieving such goals.

To ensure our future explorers will be ready to continue the journey, NASA is working with one of its most vital partners – educators. This summer, NASA will ignite the flame of knowledge with the first space flight of one of NASA's most famous educator. Mission Specialist and Educator Barbara Morgan will engage students and educators worldwide from 240 miles above Earth aboard the International Space Station.

NASA Administrator Michael Griffin recently stated, "The greatest contribution that NASA makes in educating the next generation of Americans is by providing worthy endeavors for which students will be inspired to study difficult subjects like math, science and engineering because they too share the dream of exploring the cosmos."

To this end, NASA educational investments are designed to:

- 1. Strengthen NASA and the Nation's future workforce** – NASA will identify and develop the critical skills and capabilities needed to ensure achievement of exploration, science, and aeronautics.
- 2. Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty** – To compete effectively for the minds, imaginations, and career ambitions of America's young people, NASA will focus on engaging and retaining students in STEM education programs to encourage their pursuit of educational disciplines critical to NASA's future engineering, scientific, and technical missions.
- 3. Engage 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 America's science and technology literacy.

Experience has shown that exciting and compelling NASA missions truly can inspire the next generation of explorers, innovators, and leaders. NASA's unique program content, people, and facilities can be leveraged to spark interest, capture imaginations, and guide students toward careers in STEM fields while increasing their scientific and technologic literacy to the benefit of the Nation.

To prepare future generations to manage and lead the cutting-edge research of tomorrow, strategic planning is essential. NASA has identified strategic goals and objectives that align its portfolio of education programs with the Human Capital Initiatives under the President's Management Agenda to build the workforce needed to meet core competences. All of NASA's education efforts are part of an integrated Agency-wide approach to human capital management.

NASA Education Programs support multiple goals and sub-goals in the 2006 NASA Strategic Plan. Specifically, the education programs of the Agency contribute to the following outcomes:

- Outcome 1: Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals through a portfolio of programs.
- Outcome 2: Attract students and retain them in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.
- Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

### **NASA Education Programs**

The manner in which the Agency will achieve these outcomes is detailed in the NASA Education Strategic Coordination Framework. The Framework was approved by the NASA Strategic Management Council in 2006 and guides the planning, implementation, assessment and validation of the following portfolio of programs:

The **Higher Education Program** focuses on supporting institutions of higher education in strengthening their research capabilities and providing opportunities that attract and prepare increasing numbers of students for NASA-related careers. The research conducted by the institutions contributes to the research needs of NASA's Mission Directorates.

The **Minority University Research and Education Program (MUREP)** engages underrepresented populations through a wide variety of initiatives. Multi-year grants are awarded to engage minority institutions, faculty and students in research pertinent to NASA missions. The program focuses on retaining underrepresented and underserved students in STEM disciplines through completion of undergraduate or graduate degrees and entry into the scientific and technical workforce.

The **Elementary and Secondary Education Program** provides K-12 educators with tools, experiences, and opportunities to further their education and participate in unique NASA learning experiences to enhance their knowledge of STEM and inspire pursuit of STEM careers. The program supports the role of educational institutions, which provide the framework to unite students, families, and educators for educational improvement.

**Education Technology and Products (e-Education)** sustains the research and development of technology applications, products, services and implementation of technology-enriched infrastructure in facilitating the appropriate and effective technology based applications to enhance the educational process for formal and informal education. In addition, e-Education identifies projects that will meet the objective of the President's Management Agenda to provide citizen-centric services related to NASA Education efforts.

The **Informal Education Program** is focused on increasing learning, educating students, educators and the general public on specific STEM content areas, and expanding the Nation's future STEM workforce. Projects within the program produce supplemental educational materials that are standards based and designed to support facilitators who are trained or qualified in STEM education fields, and are actively working with participants to further enhance their understanding. Informal Education Programs also develop content based on educational standards and learning objectives to supplement and enrich an experience, visual, or activity.

The breadth of our portfolio, and how these programs have been implemented nationally, can be illustrated through the following examples:

- Attracting students to the teaching profession, the **NASA Educator Astronaut** project uses the visibility and educational opportunities created by the activities of the Educator Astronauts to inspire greater K-12 STEM achievement, promote STEM careers, and elevate public esteem for the teaching profession. In selecting Educator Astronauts, NASA identified and trained hundreds of our country's top educators who are members of the Network of Educator Astronaut Teachers (NEAT). Approximately 180 NEAT members are now in communities across America, each conducting workshops that reach about 90 educators per session. These efforts result in strengthening the STEM skills of approximately 10,000 teachers annually.
- **NASA Explorers Schools (NES)** provide intensive training and on-site professional development to teachers in classrooms across the country. The NES project assists middle schools with improving teaching and learning in STEM education through professional development, stipends, grants, and curricular support based on NASA resources. In 2006, 5,339 teachers received intensive training as part of the NES project. Additionally, our Aerospace Education Services personnel conducted sessions across the Nation, reaching 13,938 educators in other schools.
- In addition to in-service workshops based on our missions, NASA is committed to the pre-service training of our future educators. Through the National Pre-Service Teacher Conference, **Pre-Service Teacher Institutes** and Online Professional Development, NASA recruits STEM teachers to develop the confidence and skills to effectively teach mathematics and science using cutting-edge technology and educational materials. Such efforts have led to 200 STEM-enhanced teachers instructing an average of 25 students per classroom for 3 years, impacting a projected total of 15,000 students.
- NASA's four Mission Directorates provide opportunities for students to engage in NASA mission related experiences. For example, within NASA's Science Mission Directorate, a broad spectrum of education activities are sponsored, ranging from kindergarten to postgraduate levels. All of NASA's science missions and programs are required to have an education and public outreach component. Through a competitive, peer-review selection process, NASA provides funding dedicated to education and public outreach to researchers. NASA also sponsors graduate and post-doctoral fellowship opportunities. In addition, the Agency is looking for new ways to provide increased opportunities for students to gain greater experience developing and launching their own science instruments, either in conjunction with science missions or through its suborbital rocket and balloon programs.
- Launched in January 2006 as part of the **New Horizons Mission**, the Student Dust Counter is the first student-built instrument selected by NASA to fly on a planetary mission. Built by students at the University of Colorado at Boulder, the counter will monitor the density of dust grains in space. This data is of particular interest to

researchers. Given the nine-year travel time, discoveries from this mission will engage today's elementary school student until college when this spacecraft encounters Pluto.

- **Aeronomy of Ice in the Mesosphere (AIM)** began its two-year mission on April 25, 2007, after a flawless ride to Earth orbit aboard an Orbital Sciences Pegasus XL rocket. AIM is the first mission dedicated to exploring mysterious ice clouds that dot the edge of space in Earth's polar regions. With AIM, Hampton University in Virginia has become the first Historically Black College and University to lead a NASA satellite mission. Undergraduate and graduate students from various STEM disciplines will have an opportunity to join faculty researchers in the analysis of collected data.
- In February 17, 2007, NASA launched five **Time History of Events and Macroscale Interactions during Substorms (THEMIS)** microsatellites to study the Earth's magnetosphere. THEMIS will help scientists understand how and why space storms create havoc on satellites, power grids, and communication systems. Students will work with scientists to unravel a variety of scientific mysteries.
- NASA's support of higher education students is embodied by **the National Space Grant College and Fellowship Program**, which continues to provide fellowships and scholarships to students across the country. Recent statistics show that, of the pool of students who completed their degrees, 31 percent were employed in STEM careers and 48% continued their education to the master's, Ph.D., or post doctoral levels. Many consortia have implemented hands-on, university student-led projects in aeronautics, rocketry, scientific ballooning, rocketry, and nano- and micro-satellite development. These types of projects provide the professional training that enable students to be fully prepared to enter the STEM workforce.

### **Portfolio Management Process**

Such a diverse portfolio requires effective management of the Agency's education portfolio both internally and externally, with clear roles and responsibilities. As the Assistant Administrator for Education, I am responsible for ensuring that the Education Outcomes as reflected in the 2006 NASA Strategic Plan are achieved. I serve as both the head of the Office for Education, managing all responsibilities assigned to the Office and also as the Chair of the Education Coordinating Committee (ECC), ensuring the overall planning, coordination, and integration of the Agency's entire education portfolio.

NASA's ECC is a collaborative structure that maximizes NASA's ability to maintain an integrated education portfolio and strategically manage the implementation of numerous programs, projects and activities in a distributed system. The committee consists of representatives of the Agency's Office of Education, the four Mission Directorates that provide mission related content, and the ten NASA Center Education Offices, among others. The committee develops education strategy and supports me in coordinating education efforts throughout the Agency. The ECC also provides checks and balances for effective internal control and ensures the successful achievement of education goals and portfolio effectiveness.

### **Collaboration and Coordination with Other Federal Agencies**

NASA's Office of Education is continually engaged in collaboration with other Federal agencies, including: the Department of Education, National Science Foundation, Federal Aviation Administration, Department of Commerce, Smithsonian Institution, Department of the Interior, and Department of Energy. Additionally, NASA collaborates with state STEM education coalitions, through the National Alliance of State Science and Mathematics Coalitions, the District of Columbia, Puerto Rico, and the U.S.

territories. Each of our Centers works closely with state and local departments of education to ensure that our resources are tailored to support the needs of the education community. We have worked hard to ensure that we understand and can respond to the needs of state or local districts.

Collaboration and coordination also occur in a number of forums in the Federal government to ensure that NASA's activities in K-16 STEM education are complementary and not redundant with the programs of other federal agencies. Additionally, NASA has actively participated in the Congressionally-mandated Academic Competitiveness Council (ACC), which found there is a dearth of evidence of effective practices and activities in STEM education and made recommendations to integrate and coordinate federal STEM programs.

In February 2007, NASA and the National Science Foundation (NSF) signed an historic agreement to work together and coordinate efforts to expand opportunities for promoting STEM education and to broaden the participation of the underrepresented in those areas. The Memorandum of Understanding (MOU) between NASA and NSF promotes a comprehensive knowledge base to be shared between the agencies to address national challenges and manage the agencies' resources more effectively. It reflects the goals of the Administration's American Competitiveness Initiative, whose cornerstone is a commitment to increase investments in basic research in the physical sciences and engineering, strengthen K-12 math and science education, and build a well-educated, skilled workforce. One of the first results of the collaboration was a three day joint NASA-NSF Research Education Opportunity Conference for Principal Investigators, Faculty, and Partners. Over three hundred members of the academic community gathered to be trained on ways to strengthen their ability to compete for research grants and to leverage their partnerships with the agencies.

Earlier this month, NASA and the Federal Aviation Administration (FAA) signed an MOU to foster the development of students' skills in STEM. The agreement supports the FAA's mission to provide the safest, most efficient airspace system in the world and NASA's mission to pioneer the future in space exploration, scientific discovery and aeronautics research. The partnership includes a broad range of cooperative outreach activities. The agencies' initial focus is on a NASA resource called, "Smart Skies." Smart Skies is an online air traffic control simulator for students in fifth through ninth grades. It offers a fun and exciting way to learn math and skills central to air traffic control while providing multiple modes of problem solving for students who learn in different ways. The agreement unites the strengths of both agencies to provide the best of aviation-related educational products and experiences to the widest possible population of students and educators.

### **Sharing Best Practices**

Through our work with the ACC, we are strengthening our evaluation methodologies and sharing some of our best practices, for example:

The **Harriett G. Jenkins Pre-doctoral Fellowship Program (JPFP)** is a model of a STEM education pipeline program that can be replicated by other agencies as a best practice. While the success of the JPFP can easily be quantified by counting the number of students participants (121), the number of awards provided to conduct research at a NASA center (90) or the number of successful mentoring relationships that were established through this program (121), the greatest accomplishment of the program is an exceptionally diverse group of underrepresented STEM scholars who are excited about pursuing NASA-related advanced degrees that will equip them to participate in the space exploration workforce. To date, the Jenkins project has produced 34 M.S. degrees and 32 Ph.D. degrees in NASA-related disciplines.

Another stellar NASA project identified as a best practice is the **Science, Engineering, Mathematics, and Aerospace Academy (SEMAA)**. The Ash Institute for Democratic Governance and Innovation at Harvard University's John F. Kennedy School of Government announced that SEMAA was among the top eighteen programs in the 2007 Innovations in the American Government Awards competition. Selected from a pool of nearly 1,000 applicants, these initiatives are being recognized as the government's

best efforts for their novelty and creativity, effectiveness at addressing significant issues, and potential to be replicated by other jurisdictions. Finalists presented before the National Selection Committee at the Kennedy School on May 15, 2007, and winners will be announced in September.

### **Evaluation of NASA Education Programs**

The Agency's many Education initiatives have not been evaluated in a comprehensive, rigorous manner to indicate how well all of our programs are performing in support of our outcome goals. We are committed, however, to enhancing and improving our evaluation procedures.

The Agency has taken several major steps to improve the evaluation function by:

- (a) incorporating a detailed evaluation plan into its Education Strategy Framework;
- (b) defining an enhanced set of outcome-based performance measures; articulating specific roles and responsibilities to ensure accountability; and,
- (c) allocating the resources necessary to support rigorous evaluations and the overall evaluation function.

A range of processes will be used to capture the total picture of education across NASA and to assess the education portfolio for its effectiveness in: achieving the stated outcomes; establishing linkages within the framework; and determining the level of quality, impact and comprehensiveness of the portfolio. The ECC will employ an appropriate mix of methodologies, ranging from basic quantitative data to qualitative information, to assess the overall condition of the education portfolio.

Coincident with the adoption of a new education framework and outcomes in FY06, NASA developed a corresponding set of objectives and outcome measures. Baselines for these measures are being established with FY07 data. The outcome measures include, but are not limited to the following:

- Percentage of student participants employed by NASA, aerospace contractors, universities, & other educational institutions.
- Percentage of undergraduate students who move on to advanced education in NASA-related disciplines.
- Level of student interest in science and technology careers resulting from elementary and secondary NASA education programs.

The most significant improvement NASA is making to its evaluation efforts is to make use of independent, credible evaluators to measure the effectiveness of education investments. Project-level evaluations will be conducted on three to five of our major projects each year, with the objective of evaluating each project at least once every five years. In collaboration with the National Science Foundation and the Office of Management and Budget, we are working to determine the best ways to apply a Randomized Controlled Trial (RCT) model of evaluation to demonstrate the impact of our portfolio of programs. Projects that cannot be reliably evaluated using RCT methods will be evaluated in an objective and credible manner, conforming to the standards of professional practices.

### **Public Awareness and Access to NASA Education Programs**

NASA Education is a cross-cutting process that engages the public in shaping and sharing the experience of exploration and discovery. The President's FY 2008 budget request for NASA's Education program is \$153.7 million. Through the Office of Strategic Communications, the Agency is building and maintaining public awareness for the activities and goals focusing on science, education, aeronautical research and exploration.

As part of the Agency's long-term strategy in promoting public awareness, National Education Campaigns designed to build a comprehensive education initiative that engage diverse audiences with tailored modes of interaction have become common practice for assisting the Agency with public

engagement and the formation of national and international visibility and recognition. STS-118, the first Spaceflight of an Educator Astronaut, is a good example of a National Education Campaign designed not only to engage students and educators but also increase America's science and technology literacy.

NASA disseminates its education content including STEM-related materials through resources designed to reach all education audiences – formal, informal and the public at-large – as well internal dissemination networks such as Aerospace Education Services Program (AESP) and Space Grant.

The NASA Portal opens the door to all the resources that NASA has available. From there, educators can either download materials for use, or obtain copies from the Central Operations of Resources for Educators (CORE). CORE is a worldwide distribution center for NASA's educational material.

### **The Role of Partnerships**

Strategic alliances with non-governmental organizations provide an immediate springboard as unfunded collaborators to produce, market, and distribute educational information about NASA's projects and programs. NASA's partnership with the International Technology Education Association is one of many venues the Agency uses to reach students and educators across the country. Other organizations include the National Science Foundation, National Institute of Aerospace, National Science Teachers Association, AOL's Kids On-Line, the Girl Scouts of the USA, Imaginary Lines, and Reader's Digest.

Imagine, with the right partners, what NASA can do to strengthen and support STEM education. Powerful technologies can enable new learning environments using simulations, visualizations, immersive environments, game playing, intelligent tutors and avatars, learner networking, and usable building blocks of content. These capabilities can create rich and compelling learning opportunities that meet the needs of learners while empowering educators to unlock the potential in each student's heart and mind. NASA can unite with the technology and education communities in dialogue, understanding and action. Students and educators can have access to a new renaissance of learning for the benefit of the Nation and the world.

### **Conclusion**

I would like to commend the Subcommittee for its efforts to improve K-16 STEM education. The educational achievement of America's next generation is an issue that reaches our Nation at all levels. NASA will continue to partner with federal, industry, state and local organizations and invest our resources toward a shared vision to secure those jobs critical to the 21st century workforce. This means not only inspiring the next generation of leaders and explorers but also providing educators with unique resources to support educational excellence in STEM while improving scientific literacy.

The President, Administrator Griffin, and all of NASA share the belief that a highly educated and well-prepared workforce has been and continues to be essential to this country and the Agency. NASA's investment in education is indeed an investment in America's future.

Thank you for the opportunity to participate in this important hearing. I am prepared to respond to any questions you may have.

## **Biography**

### **Assistant Administrator for Education Dr. Joyce Leavitt Winterton**

Dr. Joyce Leavitt Winterton, NASA's Assistant Administrator for Education, directs the development and implementation of the agency's education programs that strengthen student involvement and public awareness of its scientific goals and missions. In this role, she leads the agency in inspiring interest in science, technology, engineering, and mathematics, as few other organizations can through its unique mission, workforce, facilities, research and innovations.

As Assistant Administrator for Education, Winterton chairs the Education Coordinating Committee, an agency-wide collaborative structure that maximizes NASA's ability to manage and implement its education portfolio. The ECC works to ensure that the agency's education investments are focused on supporting the nation's education efforts to develop the skilled workforce necessary to achieve the agency's goals and objectives.

Before coming to NASA, Winterton served as the Director of Education Programs for USA TODAY, and developed educational strategies, resources and partnerships for its K-12 and collegiate programs. During her nine years at USA TODAY, she created innovative cross-curricular educational approaches, including case studies, content development and online collaborations.

She was the founder and president of Winterton Associates, a consulting firm that specializes in working on joint projects with business and industry, education, and government. The firm has served as the evaluator for National Science Foundation projects and U.S. Department of Education-funded programs, including six national skill standards projects since 1991.

Winterton's previous experience includes serving as the team leader for partner development for the National Future Farmers of America student organization, where she planned and developed partnerships and strategies to communicate the benefits of agricultural education and a student organization with over 450,000 members. She has also been an education training consultant for FranklinCovey Inc. where she facilitated time management and personal effectiveness workshops for national student leadership organizations.

In 1986, Winterton became the executive director of the National Council on Vocational Technical Education, a Presidential Advisory Council providing recommendations to the President, Congress and the secretary of education. Additionally, Winterton served as the deputy assistant secretary for vocational and adult education in the United States Department of Education and was the first director of the Presidential Academic Fitness Awards program. She also was a professional staff member for the U.S. Senate Committee on Labor and Human Resources. She has served on a number of national education boards and advisory panels.

Winterton has been a high school teacher, a teacher educator and a home economist in business. She received the Lawrence Prakken Professional Cooperation award from the International Technology Education Association and was recognized as an outstanding alumna from Colorado State University and also the Family, Career and Community Leaders of America. She earned her bachelor's and master's degrees in home economics education from Utah State University in Logan. In 1978, she completed her doctorate in teacher education and administration at Colorado State University in Fort Collins.