This year, NASA celebrates 50 years of exploring various frontiers that have led to new horizons of opportunity. As NASA implements the U.S. Space Exploration Policy, carrying humans back to the Moon, on to Mars and beyond, the Agency is also working to lay the educational groundwork that will make this ongoing journey possible.

As we commemorate this milestone of the Space Age, NASA's Science, Engineering, Mathematics and Aerospace Academy (SEMAA) is preparing the next generation of explorers as it engaged more than 57,000 students, families, and educators in 2008. SEMAA is taking a leading role in efforts to inspire interest in Science, Technology, Engineering, and Mathematics (STEM) while supporting NASA’s education goals: strengthening NASA’s and the Nation’s future workforce, attracting and retaining students in STEM disciplines, and engaging Americans in NASA’s mission. This document highlights program performance, partnership achievements and success stories including several NASA SEMAA graduates who are pursuing STEM degrees or have entered the STEM workforce.

As we move forward, our success in education as an Agency will, in part, be defined by continued investments in highly valued educational programs like NASA SEMAA. Together we can build the innovative workforce that will redefine the pinnacle of exploration excellence for future decades.

Dr. Joyce L. Winterton
NASA Assistant Administrator of Education

The Science, Engineering, Mathematics and Aerospace Academy (SEMAA) helps bridge the education gap for historically underrepresented K-12 youth in Science, Technology, Engineering, and Mathematics (STEM) through its partnership alliances with families, educators, and formal and informal education institutions. This important project provides compelling NASA learning experiences that inspire interest in STEM careers. It has a significant impact on the community, and it makes critical contributions to the STEM workforce. Fifty-two percent of students surveyed indicated that they plan to work in a STEM career after they complete their studies. As we enter 2009, SEMAA continues to play a fundamental role in assisting NASA to attract and retain students in STEM disciplines, ensuring excellence and diversity in the Agency’s future workforce needs.

Woodrow Whitlow Jr.
Center Director, NASA Glenn Research Center

SEMAA is an innovative national leader in K-12 STEM education. The National Research Council, in its review of K-12 STEM initiatives, applauded SEMAA for “its focus on underserved and underrepresented populations of students and on inspiring their interest in science and engineering.”

The project took substantial steps toward establishing new national partnerships during 2008. Among those initiatives was the unveiling of a new communications strategy to assist in expanding awareness of SEMAA among potential stakeholders and supporters, key influencer groups, and the general public. SEMAA will utilize those potential stakeholder groups and its more than 200 existing collaborations and partnerships to maximize the benefits of STEM education to K-12 students and families in communities throughout the nation.

Gail Dolman-Smith
President & CEO, Paragon TEC, Inc.
NASA SEMAA Contractor
NASA has a unique capacity to revitalize STEM education in America; utilizing its awe-inspiring subject matter, cutting-edge research opportunities, and world-class facilities. NASA is currently investing in a portfolio of educational programs/projects focused on (1) Strengthening NASA and the nation’s future workforce, (2) Attracting and retaining students in STEM disciplines, and (3) Engaging Americans in NASA’s mission. NASA SEMAA is aligned to NASA Education Outcome 2: Attracting and retaining students in STEM disciplines.

MISSION

SEMAA is an innovative, national project designed to increase the participation and retention of historically underserved and underrepresented K-12 youth in the areas of Science, Technology, Engineering, and Mathematics (STEM).

GOALS

Inspire a more diverse student population to pursue careers in STEM-related fields. Engage students, parents/adult family members and teachers by incorporating emerging technologies. Educate students utilizing rigorous STEM curricula, designed and implemented as only NASA can.

NASA SEMAA IS...

Hands-On, Inquiry Based K-12 STEM Curricula

- Aligned to National Math, Science, and Technology Standards
- Encompasses the research and technology of NASA’s four Mission Directorates
- Provides NASA SEMAA graduates with up to 441 hours of advanced studies in STEM, prior to enrollment in a post-secondary institution

Aerospace Education Laboratory (AEL)

- Places cutting-edge technology at the fingertips of NASA SEMAA middle and high school students
- Engages students in real world challenges relative to both an aeronautics and reduced gravity research scenario
- Houses real aerospace hardware/software including an Advanced Flight Simulator (AFS); a laboratory-grade research wind tunnel; and a working, short-wave receiver and hand-held Global Positioning System (GPS) for aviation

Family Café

- Promotes sustained family involvement at NASA SEMAA sites nationwide
- Provides parents/caregivers with relevant parenting and STEM education information
- Researches and presents information to parents/caregivers on other STEM-related programs available for their child’s participation, in an effort to maximize student exposure and interest in STEM
SIGNIFICANCE OF THE UNDERREPRESENTED

African Americans, Hispanics, Native Americans, and persons with disabilities make up 24% of the population, but only 7% of the science and engineering workforce; representing the biggest gap in the U.S. STEM workforce. (National Science Board. Science and Engineering Indicators, 2000)

According to STEM education research, if women and minorities participated in the science and engineering workforce proportional to their presence in the general population, there would be no U.S. talent gap.

SEMAA’S FOCUS ON THE UNDERREPRESENTED

NASA SEMAA harnesses the collective resources of NASA, institutions of higher education, science centers, museums and primary and secondary schools to bridge the education gap for historically underrepresented K-12 youth in STEM. SEMAA's focus on the underrepresented is evident in the demographics highlighted below.

2008 SEMAA Student Participant Demographics

- Ethnic Minorities (underrepresented in STEM) – 86%
- Low Income Students (below the national poverty level) – 53%
- Students with Special Needs – <1% (173)
- Females – 49%

TRANSCENDING BARRIERS

NASA SEMAA is committed to transcending barriers that stand between historically underrepresented students and the STEM classroom.

- Commitment to Homeless Students and Families – Worked collaboratively with homeless shelters within the metro Washington, D.C. area to provide SEMAA services for homeless children and families. In addition to providing services within the shelters, SEMAA personnel arranged for busing to engage participants in SEMAA classes on the University's Campus.

- Commitment to Students on the Pine Ridge Reservation Schools – SEMAA implemented an after-school robotics outreach program for five schools on the Pine Ridge Indian Reservation that captured the participation of nearly 100 elementary and middle school students. Participating students used the new LEGO® MindStorms™ Robotic System to complete simulated missions on the surface of Mars. Given the tremendous response and success of the project, and due to popular request, SEMAA is now preparing for a Reservation-Wide Robotics Competition in 2009.
NASA SEMAA is a national project, operating from 14 sites located throughout 12 states and the District of Columbia. Site locations include Historically Black Colleges and Universities (HBCU), Hispanic Serving Institutions (HSI), Tribal Colleges and Universities (TCU), science centers, museums, and elementary/secondary schools. During fiscal year 2008, NASA SEMAA sites inspired, engaged and educated 57,394 students, parents/caregivers, and teachers.

INCREASING K-12 STUDENT EXPOSURE AND INTEREST IN STEM

- Increased 3rd-12th grade exposure by 36 classroom hours annually, and K-2nd grade by 27 classroom hours annually
- Average student increase in STEM interests:
  - Science – 38%
  - Technology – 40%
  - Engineering – 48%
  - Mathematics – 36%

STRENGTHENING THE NATIONAL STEM PIPELINE

- Fostered the participation of NASA SEMAA students in 50+ other STEM programs/projects, thus maximizing student exposure and interest in STEM and strengthening the national K-12 STEM pipeline

INCREASING FAMILY INVOLVEMENT

- Provided parents/caregivers with up to 21 hours of STEM education and parenting workshops/focus groups annually
- Created exciting, hands-on, inquiry based, STEM-focused learning opportunities for students and parents/caregivers to work together

ENSURING PROJECT GROWTH THROUGH INNOVATION

- Integrated SEMAA STEM curriculum module (Astrobiology in the Secondary Classroom)
- Completed remote upgrades of SEMAA Aerospace Education Laboratories around the Country utilizing new, state-of-the-art, distance learning technologies
- Developed a National SEMAA Partnership and Sustainability Plan to ensure project sustainability beyond NASA funding
- Developed a National SEMAA Marketing and Communication Strategy to broaden project visibility both nationally and abroad

BUILDING PROJECT SUSTAINABILITY

- Collaborated with a network of 200+ partners
- Leveraged an annual record $3.9 million in sustaining funds

Funds Leveraged through Partnerships

SEMAA leveraged over $15.1 million dollars in funding for K-12 STEM education from 2004-2008
In response to mounting studies and statistics showing billions of dollars in annual U.S. spending on K-12 STEM education, and at the same time worsening gaps in the preparation of our next generation STEM workforce, the President issued a directive in 2007 mandating a review of all federally funded K-12 STEM initiatives. As a result, the National Research Council (NRC) has conducted a review and critique of each federal agency’s investments in K-12 STEM education.

In the NRC’s final report on NASA’s K-12 educational investments, entitled *NASA’s Elementary and Secondary Education Program: Review and Critique* (2008), the NRC stated the following:

“The committee commends SEMAA for its focus on underserved and underrepresented populations of students and on inspiring their interest in science and engineering... SEMAA is an excellent project for reaching the intended participants (historically underserved and underrepresented K-12 youth in STEM).”

In addition to these endorsements, the NRC recommended that SEMAA assess the cost-effectiveness of the Aerospace Education Laboratories and develop a plan to periodically update the SEMAA curriculum enhancement activities to reflect the latest NASA science and engineering activity. The NASA SEMAA leadership has developed and begun implementing a plan to address the NRC’s recommendations.

*"The project has developed a number of good strategies for reaching students and their families and has worked hard at raising matching funds to leverage the dollars provided by NASA..."*

In Miami, 60 inner-city youth, including 30 NASA SEMAA students, built a single-engine airplane as part of the “Build & Soar” program. Working as a team, under the guidance of certified aircraft mechanics and instructors, the students learned how airplanes are constructed one piece and system at a time.

The 10-week summer program was made possible by Miami-Dade County Public Schools in collaboration with Experience Aviation, the George T. Baker Aviation School, and NASA SEMAA funding.

The experimental, two-seater aircraft (a Zenith Zodiac 601 XL) passed Federal Aviation Administration (FAA) inspection, and renowned aviator Barrington Irving took it on its first flight in early October. Participating students also constructed a wind tunnel for aerodynamic research, built and launched model rockets, and participated in numerous computer-based simulations.

“At the center of the Build and Soar Project is the goal to connect education and industry through relevant project-based activities. Instructors utilize authentic tasks designed to build students’ mathematic, science, and reading skills while raising awareness to opportunities and career paths within the aviation/aerospace industry.”

Lois Lee
District Director
School Choice and Parental Options
Miami-Dade County Public Schools
Six SEMAA graduates received the 2008 NASA SEMAA Next Generation Pioneer Award. This prestigious national award is presented annually to leading NASA SEMAA graduates for their long term participation in SEMAA and subsequent accomplishments related to the study of STEM.

NASA SEMAA Next Generation Pioneers

Monica Chillious

Monica Chillious participated in SEMAA at Cuyahoga Community College (Cleveland, OH) for nine years, and has since graduated from Ohio University with a Bachelor of Science in Microbiology with a minor in Chemistry. Monica is currently employed with TREK Diagnostic Systems, where she supports products and processing techniques related to blood culturing and bacterial detection in clinical and veterinary specimens.

Taylor Tomassi

Taylor Tomassi participated in SEMAA at Fernbank Science Center (Atlanta, GA) for six years, and is currently a junior at Georgia Tech majoring in Materials Science and Engineering. Taylor interned at the WINSHIP Cancer Institute at Emory University, where she co-authored a project/paper entitled, “Cross-Species Molecular Profiling Identifies the GSK-3 Beta Pathway in Soy Mediated Prostate Cancer Growth Inhibition” at the annual meeting of the American Association for Cancer Research. Taylor has served as the Middle School Outreach Committee Chair for the Society of Women Engineers and is a recipient of the President’s Undergraduate Research Award.

Robert Johnson

Robert Johnson participated in SEMAA at SECME/Tennessee State University (TSU) (Nashville, TN) for three years, and is currently a freshman at Nashville State Community College majoring in Computer Networking and working toward his certifications in CCNA, A+, and MCDST. Robert currently serves as the Assistant Education Coordinator at SECME/TSU, where he is helping to implement the NSF-funded General Robotics Automation Sensing and Perception (GRASP) and Astrobiology in the Secondary Classroom curriculum modules for SEMAA high school students.

Ashley Jones

Ashley Jones participated in SEMAA at Morgan State University (MSU) (Baltimore, MD) for eight years, and is currently a sophomore at MSU majoring in Industrial Engineering. Ashley was the recipient of a NASA Robotics Academy Internship at the NASA Goddard Space Flight Center in 2008. Ashley is also a recent recipient of the Maryland Space Grant Scholarship and one day hopes to work for NASA. She currently serves as a mentor and robotics instructor for SEMAA students still in the K-12 pipeline.

Naomi Florentino

Naomi Florentino participated in SEMAA at SECME/Tennessee State University (TSU) (Nashville, TN) for three years, during which time she traveled by bus for more than two hours (round-trip) every Saturday to participate in SEMAA. As a SEMAA student, Naomi participated in the SEMAA GRASP curriculum and was a member of the site’s FIRST Robotics Team. Naomi graduated with honors in May 2008 and is currently a freshman at David Lipscomb University majoring in Mechanical Engineering.

Jonathan Lovegren

Jonathan Lovegren participated in SEMAA at Fernbank Science Center (Atlanta, GA) for five years, and has since graduated from Georgia Tech with a Bachelor of Science in Aerospace Engineering. For two years during his undergraduate studies, Jonathan interned as an engineer in the Advanced Development Programs Division of Lockheed Martin’s “Skunk Works” in Palmdale, California. While at Lockheed Martin, Jonathan worked on vertical takeoff and landing unmanned aerial vehicles. Jonathan is presently attending graduate school at MIT, working toward a Masters Degree.

“Through SEMAA I was able to get into hands-on programs. I was able to use knowledge and use intelligence, but in a different way than sitting at a desk... and that meant the world to me.”

Monica Chillious, Microbiologist
TREK Diagnostic Systems
INCREASING AMERICA’S RETURN ON INVESTMENT (ROI) THROUGH PARTNERSHIPS

NASA SEMAA sites are required to develop partnerships annually that will both enhance and sustain project services beyond NASA funding. During fiscal year 2008, SEMAA sites leveraged over $3.9 million in partnership funds (including both financial and in-kind support).

Below are just a few examples of local SEMAA partnerships developed during the 2008 fiscal year:

- **Jwahir Enterprises Inc. and Organization of Black Airline Pilots** - Provided $34,000 to the SEMAA Project at the University of District of Columbia to allow 216 high-school-aged students to participate in a unique, six-week Aerospace Flight Academy during the summer.

- **Workforce Development Grant** - Provided stipends in the amount of $41,828 for 125 NASA SEMAA students in the Miami-Dade County Schools who participated in two STEM-focused aerospace-themed activities.

- **Chase Foundation** - Has committed to funding a math and science project for the Artesia Schools (New Mexico) and wants SEMAA to be a part of the mix. The foundation has expressed a willingness to invest over $2 million towards the project.

- **Martinsville City Schools** - Pledged continued support for NASA SEMAA in the amount of $66,000 for fiscal year 2009.

To supplement local partnership efforts and ensure SEMAA’s long term sustainability, the newly formed SEMAA NSC developed a National SEMAA Partnership and Sustainability Plan to guide the development of the project’s first national partnerships targeted for fiscal year 2009.

A list of 2008 NASA SEMAA major partners is included on page 9.
ORGANIZATIONAL CHART

NASA Headquarters
Office of Education

NASA Headquarters
Elementary & Secondary Education Program

NASA Glenn Research Center
Educational Programs Office

NASA Glenn Research Center
NASA SEMAA Project Manager

National SEMAA Office (NSO)
Contractor: Paragon TEC, Inc.

14 NASA SEMAA SITES

1-District of Columbia (Washington, D.C.)
University of the District of Columbia, Washington

2-Florida
Miami-Dade County Public Schools, Miami

3-Georgia
Albany State University, Albany

4-Georgia
Fernbank Science Center, Atlanta

5-Maryland
Morgan State University, Baltimore

6-Michigan
Wayne State University, Detroit

7-New Mexico
New Mexico State University, Las Cruces

8-New York
York College/City University of New York, Jamaica Queens

9-North Carolina
Warren County High School, Warrenton

10-Ohio
Cuyahoga Community College, Cleveland

11-South Carolina
Richland County School District One, Columbia

12-South Dakota
Oglala Lakota College, Kyle

13-Tennessee
Tennessee State University/SECME, Inc., Nashville

14-Virginia
Martinsville City Public Schools, Martinsville

2008 NASA SEMAA BUDGET

NASA SEMAA Site Operations (14 sites) .......................................................... $1,727,513

National SEMAA Office Operations – Contractor ........................................... $1,029,393

NASA Glenn In-House Costs .................................................................. $148,607

Grand Total .................................................................................. $2,905,513

For more information on the NASA SEMAA Project, contact Paragon TEC, Inc. at (216) 361-5555, or visit the website at www.semaa.net.
“Before I came to SEMAA, I had no idea what I wanted to do. But once I got into SEMAA, that’s what got me into engineering.”

NASA SEMAA Student
Fernbank Science Center, Atlanta, GA

Albany State University
Alcoa Foundation
American Honda Foundation
American Museum of Natural History
Baltimore Metropolitan Housing Authority
DC Council of Engineering and Architectural Society
Dougherty County School System
Escraps Computers and Electronics
Experience Aviation
General Motors
George T. Baker Aviation High School
Federal Government Workforce Development Grant
Fernbank Science Center
First Book
Florida Memorial University
Florida’s 21st Century Grant
FoodBank of Southwest Georgia
Gadsden Independent Schools
General Motors
Girl Scouts of America
GLA School of Excellence
Glenn Research Center
Goddard Space Flight Center
Intel Foundation
Jet Propulsion Laboratory
Johnson Space Center
Jwahir Enterprise Inc.
Kennedy Space Center
Las Cruces Public Schools
Marshall Space Flight Center
Martha Holden Jennings Foundation
Martinsville City Schools
Miami-Dade County Public Schools
Metro Nashville Public Schools
Miami-Dade Police Department
Morgan State University
National Science Foundation
Nat’s Catering
New Mexico State Legislature
New Mexico State Senate
New Mexico State University
Northwood Appold Community Academy (NACA)
PolyCom
Project A.R.T.S. (Academics Related to Success)
RGK Foundation
Richland County School District One
SECME
Southeastern Regional Visions for Education: Science Academy Network
Tennessee Space Grant Consortium
Tennessee State University
Tennessee State University Foundation
Tommy Hilfiger Foundation
University of the District of Columbia
United Black Fund
Warren County Local Government
Warren County School District
Wayne State University
Weeks Gas
Zero Gravity Project
“Before I entered SEMAA at Morgan State University, I hated Science, Math, and Technology; now I love all of it! It even raised my grades. Thanks for everything.”

NASA SEMAA Student
Morgan State University, Baltimore, MD

“The NASA SEMAA Project is an integral part of our engineering pipeline here at New Mexico State University. Some of our first SEMAA graduates are now returning as New Mexico State University students. We are thrilled!”

Steven Castillo,
Dean of Engineering
New Mexico State University, Las Cruces, NM

“SEMAA is making a tremendous difference among every student that I’ve interacted with...at every level, I’ve experienced students that have had their lives changed by this program”

Nathaniel Haeck,
NASA SEMAA Teacher
Fernbank Science Center, Atlanta, GA

For more information, visit www.semaa.net Prepared by Paragon TEC, Inc.
The Office of Management and Budget (OMB) has assessed Federal Government programs using a standard questionnaire called the Program Assessment Rating Tool (PART). The questions relate to a program’s performance and management, and Federal agencies provide detailed explanations and evidence to support their answers on the questionnaire. The program ratings range from Effective at the highest to Ineffective or Results Not Demonstrated at the lowest end of the scale. All PART evaluations contain follow-up actions and improvement plans. OMB has assessed 1,004 Federal programs, or 98 percent, of all Federal programs. The results are available to the public at www.expectmore.gov.

NASA Education participated in the PART in 2008. SEMAA data submitted to NASA’s Office of Education in support of the 2008 PART is outlined below.

**PART Measures**

**Percentage increase in number of elementary and secondary student participants in NASA instructional and enrichment activities**

FY2007 Baseline (17,773 Direct Student Participants) 
In FY2008 the project served 18,894 direct students resulting in a 6.3% increase over FY2007. Additionally, SEMAA served 21,763 Indirect Students for a total of 40,657 K-12 student participants in NASA instructional and enrichment activities.

**Level of student interest in science and technology careers resulting from elementary and secondary NASA education programs**

52% of respondents (Direct Student Participants) in grades 4-12 indicated plans to work in a STEM career after completing their studies, representing a 2% increase over the FY 2007 result of 50%.

**40.3% was the overall average increase in student interest in STEM**

- 37.5% average increase in Science
- 40.0% average increase in Technology
- 48.0% average increase in Engineering
- 35.5% average increase in Mathematics

More than 86% of respondents either “Agreed” or “Strongly Agreed” that they learned more about careers in STEM, resulting in a 4.4 average rating on a 5.0 rating scale.

Note: Feedback collected from Direct Student Participants in grades 4-12.
Output Measures

Percentage increase in number of elementary and secondary student participants in NASA instructional and enrichment activities

18,894 Direct Student Participants (88% ethnic minorities, 49% female)

Ethnic Breakdown
- American Indian/Alaska Native = 546
- Asian = 597
- Black/African-American = 12,557
- Hispanic/Latino(a) = 3,242
- Native Hawaiian/Pacific Islander = 7
- Multi-Racial (Two or More Races) = 107
- White (Non-Hispanic) = 1,673
- Other = 165

Gender Breakdown
- Males = 9,603
- Females = 9,291

Grade
- Grades K-4 = 9,825
- Grades 5-8 = 6,499
- Grades 9-12 = 2,570

Students with Special Needs
Direct Student Participants with Special Needs = 173

Students Living Below the Poverty Line
Percentage of Direct Student Participants Living Below the Poverty Line = 53%

Number of elementary and secondary student participants in NASA-sponsored extended learning opportunities

32,132 Total Outreach Participants (K-12 Students)

Breakdown of Outreach Numbers
- AEL Student Outreach Participants = 11,794
  - American Indian/Alaska Native = 841
  - Asian = 376
  - Black/African-American = 5,658
  - Hispanic/Latino(a) = 2,051
  - Native Hawaiian/Pacific Islander = 10
  - Multi-Racial (Two or More Races) = 8
  - White (Non-Hispanic) = 1,687
  - Other = 1,163
  - Males = 5,288
  - Females = 5,746

Other Student Outreach Participants = 9,969
- Other Outreach Students with Special Needs = 127
Number of opportunities for family involvement

SEMAA provided a total of 234 opportunities for family involvement during FY 2008.

SEMAA also engaged 6,368 parents/adult caregivers in the Family Café.

Outcome Measures

Activities and investigations result in increased student interest in STEM

40.3% was the overall average increase in student interest in STEM
37.5% average increase in Science
40.0% average increase in Technology
48.0% average increase in Engineering
35.5% average increase in Mathematics

Note: Feedback collected from Direct Student Participants in grades 4-12.

Activities and investigations result in increased student knowledge about careers in STEM

More than 86% of respondents either “Agreed” or “Strongly Agreed” that they learned more about careers in STEM, resulting in a 4.4 average rating on a 5.0 rating scale.

Note: Feedback collected from Direct Student Participants in grades 4-12.

Global Efficiency Measures

Ratio of funds leveraged by NASA funding support

In FY2008, SEMAA sites leveraged $3.9 Million (Financial and In-Kind Contributions) in support in matching funds for project operations nationwide, supported by a network of 200+ partners.

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