NASA MINORITY UNIVERSITY RESEARCH AND EDUCATION PROJECT (MUREP) AEROSPACE ACADEMY (MAA)

FY 2016 ANNUAL PERFORMANCE REPORT

FUNDING SOURCE:
OFFICE OF EDUCATION
MUREP

LINE OF BUSINESS:
STEM ENGAGEMENT

MANAGING ORGANIZATION:
JOHN H. GLENN RESEARCH CENTER
OFFICE OF EDUCATION

ACTIVITY MANAGER:
PRISCILLA A. MOBLEY
216.433.8333
PRISCILLA.A.MOBLEY@NASA.GOV
ACTIVITY DESCRIPTION

NASA’s Minority University Research and Education Project (MUREP) investments enhance the research, academic, and technology capabilities of MSIs through multi-year awards. Awards assist faculty and students in research and provide authentic Science, Technology, Engineering, and Mathematics (STEM) engagement activities related to NASA missions. These competitive awards provide NASA specific knowledge and skills to learners who have been historically underrepresented and underserved in STEM. MUREP investments also assist NASA in meeting the goal of a diverse workforce through student participation in internships, scholarships, and fellowships at NASA Centers and the Jet Propulsion Laboratory (JPL).

The MUREP Aerospace Academy (MAA) advances student development through activity components that are integrated in a comprehensive support system. MAA targets student and family audiences, particularly in grades K-12, and their parents/adult caregivers by the offering of three core components:

- **Curriculum Enhancement Activities (CEA)** - A suite of K-12, hands-on, inquiry-based STEM-focused content aligned to national science, math, and technology standards at each grade level.

- **An Aerospace Education Laboratory (AEL)** - A computer-based setting that puts technology at the fingertips of MAA elementary, middle and/or high school students to apply skills previously learned in authentic ways.

- **A Family Café/Family Involvement** - An interactive forum that provides STEM education and optimal parenting information to any supportive adult role model(s) who interacts with the student.

During FY 2016, the MAA activity was implemented at 9 sites located in 7 states across the nation. Site locations included community colleges, four-year colleges/universities, Historically Black Colleges or Universities (HBCUs), Hispanic-serving Institutions (HSIs), Predominately Black Institution (PBI), and Asian American and Native American Pacific Islander-serving Institutions (AANAPISIs).

ACTIVITY GOALS

The goals of the MAA activity are to increase participation and retention of historically underserved and underrepresented K-12 youth in the areas of STEM by providing funds and other resources to minority-serving institutions (MSIs) which develop and provide avenues for inspiring students in STEM fields. The specific goals of the MAA are to:

- Improve STEM literacy by engaging students, family members, and teachers through the integration of emerging technologies; and

- Educate students utilizing a STEM curriculum that meets national STEM standards aligned to NASA’s mission directorates.
The objectives that support the goals of MAA are:

- Increase the number of historically underserved and underrepresented students interested in NASA specific STEM careers;
- Provide skills to parents/caregivers to work with and encourage their children in STEM activities and programs;
- Involve community groups, business, industry, museums and educational and professional organizations through mentoring, field trips, guest speakers and other MAA activities; and
- Engage students in participatory activities such as hands-on learning, research, use of advanced technology, peer support groups, and mentoring relationships with professionals working in the STEM fields.

**ACTIVITY BENEFIT TO PERFORMANCE GOALS**

**FY 2016 Performance Goals**

2.4.2: Continue to support STEM educators through the delivery of NASA education content and engagement in educator professional development opportunities.

The MAA project contributed to this goal by helping to advance the Nation’s STEM education and workforce pipeline by working collaboratively with other agencies and institutions to engage 986 educators (who consisted of certified teachers, informal educators, and faculty) in NASA’s missions and unique assets.

2.4.5: Continue to provide opportunities for learners to engage in STEM education engagement activities that capitalize on NASA unique assets and content.

The MAA continued its efforts to engage 13,105 students in participatory, inquiry-based activities such as hands-on learning opportunities, research on various STEM topics and themes, use of advanced emerging technologies, peer support groups, and mentoring relationships with professionals working in STEM fields. A specific goal for this objective was to increase the number of historically underserved and underrepresented students interested in NASA specific STEM careers.

**ACTIVITY ACCOMPLISHMENTS**

FY2016 accomplishments per MAA awardee:

**California State University, Fresno (CSU, Fresno)**

The CSU, Fresno MAA site partnered with the California Teaching Fellows Foundation (CTFF) and other business/community partners to implement MAA in the Madera Unified School District (MUSD). Pre-service teachers delivered 36 hours of CEA content to MUSD 1st through 8th graders as a component of the existing afterschool program delivered by CTFF. A MAA AEL was established on the campus of CSU, Fresno and was equipped accordingly. Certified flight instructors, NASA educators, the AEL Coordinator, and MAA instructors led workshops that connected CEAs with AEL activities for students, educators, and families. Family nights and home-based family initiatives integrated CEAs for sessions on a weekly basis, while family Focus Groups were held one Saturday per month. Program expansion resulted from schools requesting NASA MAA programming and led to Summer Academies both on/off campus.

**Cuyahoga Community College (CCC, or Tri-C)**

The Tri-C MAA site offered STEM-based activities that aimed to deepen STEM learning which involved field trips to off-site organizations. High school students’ explored the NASA Visitor Center
at the Great Lakes Science Center to gain an understanding of how astronauts live in space and conducted hands-on experiments with numerous exhibits and galleries. Students also experienced the hands-on interactive *Math Alive* exhibit to learn how math concepts are designed to show a functional relationship while pedaling a bicycle. Similarly, fourth and fifth grade participants researched natural resources, rocks, and minerals at the *Watershed Stewardship Creek* to gain more understanding of the characteristics of Earth’s natural resources.

While scholars engaged in CEAs, approximately 250 parents and family members participated in family learning workshops that supported intergenerational learning. For eight weeks throughout each quarterly session, this four-hour forum invited the parents and community to discuss topics of sustainability, financial aid resources, effective parent/teacher strategies, STEM careers, and college resources. Parents also engaged in Star Lab activities inside the portable planetarium to learn more about weather patterns, aerospace, and other astronomy based facts.

**Elizabeth City State University (ECSU)**
The ECSU MAA site developed CEAs, established its AEL, designed a separate mobile trailer, and conducted multiple Family Connection events. ECSU’s MAA provided hands-on learning activities for students through Friday, Saturday, and Summer Academies. Two one-week residential summer academies were conducted on the campus of ECSU for high school students. Five one-week non-residential (satellite) summer academies were also conducted for middle school students in partnership with neighboring school districts (Elizabeth City/ Pasquotank, Perquimans, Edenton/ Chowan and Martin) middle school students. Additionally, ECSU’s MAA conducted four summer academies at Warren County High School for students from all grade levels. The ECSU MAA activity was recognized and highlighted during three separate presentations at the North Carolina Bridging-the-Gap Conference.

The ECSU MAA state-of-the-art AEL features collaborative learning furniture that can accommodate up to 60 students, and is equipped with over 14 work stations. A new Mobile Aerospace Education Lab (m-AEL) was unveiled to the public in January of 2017. The 40-foot/ 5th wheel mobile self-contained state-of-the-art STEM lab is utilized by reaching underserved and underrepresented school districts within the northeastern North Carolina region and beyond to build STEM foundational knowledge and skills for K-12 audiences.

**Hartnell Community College (HCC)**
The HCC MAA site sustained funds from partnering school districts to implement the MAA activity during school hours. Due to these partnerships, the number of contracts with school districts increased to four which exceeded Hartnell’s proposed goal of two per year. The successful completion of contracts and strong partnerships enabled Hartnell’s MAA to increase the interest of students, parents, teachers, schools, districts and programs towards STEM-related fields. The Hartnell MAA hosted events such as NASA STEM Awareness Days to increase the interest of participants in the program.

The number of students served increased significantly compared to Hartnell’s proposed student reach total. The number of MAA requests and inquiries grew significantly as the community recognized and became increasingly aware of the MAA at HCC and its overall impact. During FY 2016, HCC MAA strengthened networks with NASA Ames Research Center, which has been instrumental in helping the MAA carry out its first NASA STEM Day at the community college. More than 80 K-12 educators (formal and informal) united with HCC MAA and STEM education specialist for a day of STEM-related activities, training, and events.
**Morgan State University (MSU)**
The MAA site used CEAs to engage student learners in STEM-related subjects. The MAA leadership team collaborated with the National Science Teachers Association (NSTA) for a one-year subscription for educator professional development (EPD) to equip teachers in staying up-to-date on STEM content and subject matters for authentic learning in STEM. The site also solidified partnerships with two local schools to offer STEM activities to increase the number of students served in the local Baltimore area through MSU MAA activities.

The MAA site hosted their Fifth Annual STEM Extravaganza Day on campus which showcased the visibility of the MAA activity to the greater Baltimore County area. The objective of STEM Extravaganza Day was to raise the public’s awareness of NASA, NASA MAA, and unique NASA curriculum offered, as well as encourage youth to pursue careers in STEM and parents to support their endeavors in doing so. The 511 participants included students, parents, family members, and members of the general public.

The MSU MAA site executed a major renovation of its former AEL despite earlier challenges securing classroom space on campus. MSU MAA now houses an AEL with computer workstations using NASA content to engage learners through emerging technologies.

**Tennessee State University (TSU)**
The TSU MAA site started its first Saturday Math and Science Academy. The MAA site offered four Saturday Math/Science Academies within the quarter. As part of a final year-end workshop, students visited the Adventure Science Center and learned about STEM and other areas of academic discipline. The spring semester was followed by a two-week Summer Math/Science Academy. Students participated in hands-on inquiry-based NASA curriculum activities. After the completion of summer activities, program staff immediately began the redesign of its AEL; the laboratory was organized to be more user friendly. AEL program software and equipment were updated and repaired. The revamping of the AEL allowed the program to utilize the facility on an increased basis.

TSU MAA conducted many outreach initiatives. The TSU MAA site hosted guest speakers, interrelated activities, and a visit by a NASA Engineer from the Marshall Space Flight Center (MSFC). Speaker series themes included: *Making Your Child College and Career Ready, Renewable Energy, Week of the Young Child,* and others.

**Texas State University, San Marcos**
Efforts to enrich students in the STEM fields at the Texas State University, San Marcos MAA site included eliminating barriers such as transportation to after-school programs and other opportunities. 83% (5 out of 6) of the elementary schools in the San Marcos Independent School District (SMISD) participated in a home-based NASA Exploration Family Backpack Program. The program was offered to 4th and 5th grade classrooms. This innovative program took enriching STEM hands-on activities to families, whereas a reported 460 families and 21 teachers participated. Each 4th and 5th grade teacher in the San Marcos Consolidated Independent School District (SMCISD) circulated a classroom backpack to each student throughout the year filled with a family STEM activity, some including the NASA museum in a box resource. Each family recorded their results and experiences in an on-going journal. The students returned unused materials and shared their family reports with classmates after completing the activity. Teachers had the opportunity to replenish and swap backpacks with other teachers to expose additional students and their families with new experiences.
The Family Backpack Program initiative was not only unique, but provided a rare dynamic for students and families to work together on STEM-content inside the confines of their home. Texas State University, San Marcos MAA also infused a unique Family Involvement aspect during after school hours, separate from the Family Backpack Program. Educator professional development is a focal point of this site and they also offered strong components in STEM education and engagement with diverse audiences.

University of Texas at El Paso (UTEP)
The UTEP MAA site caters to a population of predominantly Hispanic, Spanish speaking citizens. The MAA site used NASA Curriculum to engage their K-12 learners and partnered with seven school districts throughout El Paso County. The UTEP MAA site implemented each of the three core components, while ensuring that the greater community and surrounding education institutions had a place to participate in the program by working with schools in their region. UTEP MAA hosted some of the following activities: science fair competitions, career day expositions, outreach activities for students and adult family members, AEL tours and lab visits, and the 2016 Southwest Emerging Technology Symposium.

To foster interest in STEM education, students were able to participate in the Museum of Science Fiction (MOSF) sponsored CubeSat competition. The competition challenges K-12 students to design a mission for a satellite to be launched into a low earth orbit. The “Stellar Students,” a team of 19 dedicated, pre-college engineering students were recognized during the MOSF CubeSat Team Media Presentation. The victory was a major milestone in the student’s lives especially since the competition was open to all high school students from around the globe. This was a monumental achievement for a group of students from a town like El Paso, Texas, to win an opportunity to put a satellite into orbit around the earth. Upon the announcement, the UTEP MAA and the NASA MUREP Institutional Research Opportunity (MIRO) Center for Space Exploration and Technology Research (cSETR) staff continued the outreach by developing a small satellite research facility to house the design, fabrication, and testing efforts to be conducted by the winning team. During the summer, students were invited to utilize the MAA’s facilities to continue the development of this activity and other related STEM projects.

York College, City University of New York (CUNY)
The York College MAA site offered NASA STEM content to the greater Queens area and other boroughs of New York City. York College MAA provided science, mathematics, engineering and aerospace concepts to students in grades one through nine throughout the year. The site equipped Family Café parents and caregivers to become STEM conscientious and appreciate NASA STEM outreach and the strategic importance of receiving STEM information at early ages in relation to their children’s education. MAA activities highlighted robotics and Legos as special offerings and utilized Evolution (EV3) Mind Storm Kits for students to program, operate and understand the science and mathematics concepts about obstacles/paths and complex geometric patterns. York College MAA joined NASA Edge: Game Changing Robotics Online Conference and shared pertinent information with 8th and 9th graders.

The MAA at York College fulfilled many community needs. The majority of York College MAA parents are immigrants and English as a Second Language (ESL) learners who benefit immensely from the MAA by obtaining critical information about educational opportunities for their children. One grandfather took the initiative to make sure his grandchildren were not deprived of NASA STEM content.
education. The grandfather made a two hour commute from the Bronx to Queens each time to bring his four grandchildren to the York College MAA. Family café/involvement displayed to parents how to locate and retrieve pertinent information for programs such as specialized high school admission, SAT, math and science tutoring, College Now, and online NASA education resources for enhancing their understanding of STEM, for themselves and their children alike. Since York College is the only NASA MAA site in its geographic region, high demands were exerted on the Family Café to respond and support parents with guidance to keep their children on track with goals for the next level of their academic journey.

**ACTIVITY CONTRIBUTION TO ANNUAL PERFORMANCE INDICATORS (APIs)**

**FY 2016 Annual Performance Indicators**

ED-16-2: Engage with at least 80,000 educators in NASA-supported professional development, research, and internships that use NASA-unique STEM content.
- 986 educators were engaged in educator professional development that used NASA-unique STEM content.

ED-16-5: Engage with at least 600,000 elementary and secondary students in NASA STEM engagement activities.
- 13,105 student participants (48% Female).
- Served 27,935 participants in NASA STEM content
  - 13,105 students (48% Female)
  - 12,620 outreach
  - 2,210 parents/families

**ACTIVITY IMPROVEMENTS MADE IN THE PAST YEAR**

Improvements were made for both evaluation and implementation activities. One of the main focus areas was Activity Management in which the activity manager monitors project funds on a periodic basis. Secondly both quarterly and annual performance monitoring strategies have proven to be beneficial. In this capacity, site visits are conducted either in person, virtual or via teleconference on a quarterly basis. Site responsibilities include the submission of quarter/annual reports and project highlights. To track the status and progress of challenges and communications with the MAA sites, a Technical Assistance (TA) Plan was developed for each. All requests are logged, recorded and populated on each sites’ individual TA Plan for follow-up and to ensure satisfaction in resolving any challenges.

Next is the MAA Compliance Checklist and Scorecard. Any issues that arise from the documents stated in this section are clarified and resolved during quarterly virtual site visit calls with each site.

Another element that has added to the improvements made during the past year are specific to evaluation related activities. The MAA evaluation is a multi-year approach to developing MAA cooperative agreement awardees institutional capabilities to design and conduct high quality evaluations of their activities. It also provides an overall assessment of the nation-wide progress MAA sites have made towards achieving the goals and objectives of MUREP and the MAA. The purpose of the MAA evaluation activity is to: 1) identify common measures and metrics, instruments, and data sources that each individual MAA site is using (metaevaluation), 2) synthesize MAA sites’ progress in
achieving MUREP goals and objectives (evaluation synthesis), and 3) make recommendations for providing technical assistance to build MAA sites’ evaluation capacity to better support future synthesis MAA program evaluation efforts (metaevaluation).

**ACTIVITY PARTNERS AND ROLE OF PARTNERS IN ACTIVITY EXECUTION**

MAA sites are required to develop partnerships. These partners provide financial and/or in-kind contributions to enhance and sustain MAA STEM activities beyond NASA funding. Direct investments are those that come in the form of a monetary value (i.e. grants, scholarship funds, actual financial investments) while in-kind investments are estimates that result in a service or venue that does not require financial assistance to cover a cost (i.e. room/ space provided, lights, computers provided by the institution, etc.).

MAA partnership funds (*including both financial and in-kind support*) were vital to the success of K-12 STEM education and program operations. Lists of partners who provided contributions which supported day-to-day operations on behalf of the MAA activity are provided in the following tables:

**List of Financial Contributors**

<table>
<thead>
<tr>
<th>Corporate Donors</th>
<th>Grants/ Scholarships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoa Foundation</td>
<td>Martha H. Jennings</td>
</tr>
<tr>
<td>Time Warner Cable</td>
<td>Nancy Buck Ransom Foundation</td>
</tr>
<tr>
<td>Con Edison</td>
<td>Texas Space Grant Consortium</td>
</tr>
<tr>
<td>PPG Industries</td>
<td>Thomas H. White</td>
</tr>
<tr>
<td></td>
<td>US Department of Education</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Private Donor</th>
<th>Public Donor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alisal Union School District</td>
<td>Fay Sharpe</td>
</tr>
<tr>
<td>National Grid</td>
<td>The Reginald F. Lewis Foundation, Inc.</td>
</tr>
</tbody>
</table>

**In-Kind (internal) Contributions:** Any donation received by entities that serve as a host for the MAA activity or the location to which the activity took place (*i.e. College/University or School District, etc.*).

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Type of Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbottston Elementary school</td>
<td>Teachers stipends</td>
</tr>
<tr>
<td>Al-Rahmah school</td>
<td>Teachers stipends</td>
</tr>
<tr>
<td>Cuyahoga Community College</td>
<td>Classroom space, office, computer labs, occupancy, and administrative support.</td>
</tr>
<tr>
<td>Hartnell Community College</td>
<td>Alisal Union School District - Migrant Education Program provided teachers and supplies for the activity.</td>
</tr>
<tr>
<td>Morgan State University</td>
<td>Classroom space and computer labs, printing/copying, site director's salary.</td>
</tr>
</tbody>
</table>
### In-Kind (external) Contributions:
Any entity that provided a donation or external gift and are independent of where the MAA activity took place (i.e. company, partnering organization, etc.).

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Type of Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Museum of Natural History</td>
<td>Provided free tickets worth nearly the value of one-thousand dollars.</td>
</tr>
<tr>
<td>Aqua Sports</td>
<td>Donated air fills, reduced equipment fees, Dive Instructions from the Professional Association of Diving Instructors (PADI) and expertise for the implementation of Dive Into Space.</td>
</tr>
<tr>
<td>Fresno County Sheriff’s Office</td>
<td>Used two officers from the local Dive Unit to donate their time, equipment and expertise to help support the Dive Into Space Mission activity. An exact dollar amount has not been provided, a conservative estimate was accumulated based on the service.</td>
</tr>
<tr>
<td>Little Bits</td>
<td>Discount purchase for Little Bits Technology for AEL usage.</td>
</tr>
<tr>
<td>Migrant Education</td>
<td>Transportation of students to Fresno State, meals, T-shirts &amp; staffing (x2).</td>
</tr>
<tr>
<td>Philosophic Solution Institute (PSI)</td>
<td>Curriculum development, teacher training/coaching.</td>
</tr>
<tr>
<td>St. Vincent de Paul</td>
<td>Teachers stipends</td>
</tr>
<tr>
<td>TecH2O Center</td>
<td>Estimate cost for using facilities.</td>
</tr>
<tr>
<td>Upward Bound</td>
<td>Purchase of materials, additional staff, meals, T-shirts, and use of facilities at Madera Community College Center for three weeks.</td>
</tr>
</tbody>
</table>