MINORITY UNIVERSITY RESEARCH AND EDUCATION PROGRAM (MUREP) OTHER OPPORTUNITIES (MOO)

FY 2018 ANNUAL PERFORMANCE REPORT

FUNDING SOURCE:
OFFICE OF STEM ENGAGEMENT
MINORITY UNIVERSITY RESEARCH AND EDUCATION PROJECT (MUREP)

MANAGING ORGANIZATION:
NASA JOHNSON SPACE CENTER,
OFFICE OF STEM ENGAGEMENT

ACTIVITY MANAGER:
MISTI MOORE, MOO ACTIVITY MANAGER
281-483-6716
MISTI.M.MOORE@NASA.GOV
**ACTIVITY DESCRIPTION**
The Minority University Research and Education Project (MUREP) is administered through NASA's Office of STEM Engagement (OSTEM). Through MUREP, NASA provides financial assistance via competitive awards to Minority Serving Institutions, or MSIs, including Historically Black Colleges and Universities, Hispanic Serving Institutions, Asian American and Native American Pacific Islander Serving Institutions, Tribal Colleges and Universities, other minority-serving institutions, and eligible community colleges, as required by the MSI-focused Executive Orders. These institutions recruit and retain underrepresented and underserved students, including women and girls, and persons with disabilities, into Science, Technology, Engineering, and Mathematics (STEM) fields.

MUREP investments enhance the research, academic and technology capabilities of MSIs through multiyear cooperative agreements. Awards assist faculty and students in research and provide authentic STEM engagement related to NASA missions. Additionally, awards provide NASA-specific knowledge and skills to learners who have historically been underrepresented and underserved in STEM. MUREP investments assist NASA in meeting the goal of a diverse workforce through student participation in internships and fellowships at NASA Centers and the Jet Propulsion Laboratory (JPL).

As an integral part of this mission, MUREP Other Opportunities (MOO) have been established to strengthen curriculum and curricular pathways in STEM, and to attract, retain, and support the success of underrepresented students in STEM degree programs.

MOO advances NASA Strategic Objective 3.3 to inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities through the following goals:

**ACTIVITY GOALS**
The institutions operating under an active MOO cooperative agreement have customized goals and objectives that are unique to their university environment and NASA-related research. The awardees differ in the underrepresented populations they target for participation, the academic degree areas they focus on, the level of higher education students who participate, and the focus of the Center research infrastructure development efforts.

In addition to producing valuable research activities and education programs at their institutions, many of the awardees incorporate K-12 education programs to create pipelines for STEM education, are heavily involved with educator professional development, and seek out effective partnerships to expand their research and technological developments.

The overall goals of the MOO Activity are the following:

- The potential to increase the number of minorities in STEM education areas relevant to NASA.
- Contribute to the effective implementation of NASA’s educational goals and objectives using NASA’s unique assets and capabilities.
- Increase the number of available STEM courses and curricular pathways.
• Attract, retain, and support the success of students in STEM degree programs, and subsequently in NASA-related careers.

• Increase the number of students who complete STEM certificates/degrees from backgrounds that are historically underrepresented in STEM.

**ACTIVITY BENEFIT TO PERFORMANCE GOALS**

**FY 2018 Performance Goals**

3.3.3: Provide opportunities for learners to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.

2,002 direct participants benefited from the NASA MOO activity. Indirectly MOO affected 2,375 people.

**New York City College of Technology: New Horizons in Space Additive Manufacturing and STEM Education**, Historically Black Colleges and Universities (HBCU) & Hispanic Serving Institution (HSI)

- 6 NASA Internships
- Over 100 students attended the summer research opportunity for Additive Manufacturing in collaboration with NASA’s Goddard Institute for Space Studies (GISS)

**Elizabeth City State University: Pathways in Mathematics Education and Remote Sensing (PiMERS)**, Historically Black Colleges and Universities (HBCU)

- 1 NASA Internship
- Eight pre-service teachers participated in NASA Globe training
- 300 middle school girls & 50 pre-service educators participated in 2-week STEM summer camp featuring citizen science through the NASA’s Globe Activity

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<th>Male</th>
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<th>Hispanic</th>
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</table>

**Howard University: NASA Early Opportunities Program for Underrepresented Minorities in Earth and Space Sciences**, Historically Black Colleges and Universities (HBCU)

- 6 NASA Internships
Lawson State Community College: Inspiring Tomorrow’s Leaders in Science and Engineering, Historically Black Colleges and Universities (HBCU)

- 2 NASA Internships
- 9 directly funded NASA Community College Aerospace Scholars (NCAS) who attended onsite immersive experiences at a NASA center

University of Hawaii: Hawaii’s Engaged STEM Pathways (HESTEMP), Asian American and Native American Pacific Islander Serving Institution (AANAPISI)

- The project activities target the students from rural, semi-isolated and low-income communities and families with diverse socio-economic backgrounds. The project’s “target” students are Native Hawaiians, Filipinos, Micronesians and Samoans, all of whom are underrepresented and underserved in the STEM fields according to the US Department of Energy (DOE) National Center for Education Statistics and Hawaii Academies Report of the DOE of the State of Hawaii. One hundred and eighty-eight participants collaborated with NASA’s Ames Research Center to provide data for 10 different projects. NASA Earth Science Mission key projects included atmospheric aerosol studies, effects on ocean species simulating phytoplankton’s influences on ocean color, small satellite technology, planetary landing technology, unmanned aerial systems, deep space missions, water extraction on Martian soil and space debris.

University of Texas, El Paso: Model for Resource, Reuse, and Active Learning in Interdisciplinary STEAM, Hispanic Serving Institution (HSI)

- Pick-N-Learn (PNL) curriculum developed and incorporated using NASA’s robotics and rocketry activity guides. Pick-N-Learn has created a database of NASA educational lessons and media to be used in PNL programming with regional learners and disseminated to teachers at conferences and professional development. Eight hundred and forty-six students have used system throughout FY18.

3.3.4: Enhance the effectiveness of education investments using performance assessment and evaluation-driven processes.

- All NASA MOO activities are required to use independent evaluators to assess the projects impact, execution, and performance. External evaluators meet with NASA’s MOO activity manager at yearly onsite campus visits to communicate qualitative and quantitative data that tracks participant progress and research development through formative and summative feedback.

3.3.5: Provide opportunities for learners to contribute to NASA’s aeronautics, space, and science missions and work in exploration and discovery.

- Fifteen NASA Internships funded through MOO in FY18.
- One hundred and eighty-eight participants collaborated with NASA’s Ames Research Center to provide data for 10 different projects. NASA Earth Science Mission key projects included atmospheric aerosol studies, effects on ocean species simulating phytoplankton’s influences on
ocean color, small satellite technology, planetary landing technology, unmanned aerial systems, deep space missions, water extraction on Martian soil and space debris.

**ACTIVITY ACCOMPLISHMENTS**

**New York City College of Technology: New Horizons in Space Additive Manufacturing and STEM Education**

New York City College of Technology (CUNY), NASA Langley Research Center, North Carolina State University, and The New York City Research Initiative of GISS partnered to improve additive manufacturing STEM curriculum for undergraduate education in order to improve retention and graduation rates among students traditionally underrepresented. Additive manufacturing is emerging as the second industrial revolution, which is conquering several industries including NASA. The technical drive fully equipped students with the knowledge and skills needed to enter the workforce of NASA and aerospace industry. NASA and industry research, internships, K-12 STEM Summer Camps, and educator professional development opportunities are provided during the project.

- Updates made to 5 undergraduate courses: Advanced Solid Modeling (IND2304), Engineering Graphics (MECH1222), Rapid Prototyping (MECH3520) and Materials Testing (MECH2426)

**Elizabeth City State University: Pathways in Mathematics Education and Remote Sensing (PiMERS)**

Elizabeth City State University, Pathways in Mathematics Education and Remote Sensing (PiMERS) collaborated with NASA Langley Research Center to impact over 600,000 pre-college students, 100 pre-service educators, and 200 middle and high school educators. PiMERS provided multiple activities to inspire Science, Technology, Engineering, and Mathematics (STEM) through delivery of STEM engagement events, partner-delivered educator professional development sessions, and NASA internships. Thirty percent of the allocated budget was used directly to fund minority student’s stipends, work-study, scholarships, and/or internships. This project modeled how to effectively reach representatives of diversity and continues to support and provide opportunities to engage youth and educators.

- Eleven (11) undergraduate and three (3) graduate students receive scholarships and fellowships through the PiMERS project at ECSU totaling $17,500.00. These students were mathematics, computer science and mathematics education majors.

**Howard University: NASA Early Opportunities Program for Underrepresented Minorities in Earth and Space Sciences**

Howard University, the University of Maryland Baltimore County, and Goddard Space Flight Center (GSFC) established a joint educational effort to expose underrepresented minority STEM students to early career pathway opportunities in NASA-related Earth and Space Science research. The partners awarded six STEM Howard University freshman students NASA research opportunities throughout their four-year undergraduate academic career. Research areas included energetic radiation environment on Mars and Phobos, plasma environment on the moon, non-traditional elemental proxies for redox, Cassini data analysis, and lunar exosphere examination using ground-based observations. Throughout the experience students participate in three NASA summer internships at GSFC to further
develop their research, and then culminate research with a Capstone Project & Senior Thesis. This experience provides a wide array of enriching activities to help students academically and professionally and become well-prepared to enter the NASA workforce.

- The project has benefited 15 underrepresented STEM students of African American descent by engaging them in cutting-edge research at the frontiers of NASA Earth and Space Science.

**Lawson State Community College: Inspiring Tomorrow’s Leaders in Science and Engineering**

Lawson State Community College, University of Alabama, NASA Ames Research Center, and NASA Marshall Space Flight Center joined forces to expand pathways for underrepresented groups through STEM programs for high school students, NASA relevant coursework for undergraduate students, space-related research projects, and summer internship experiences that increase the readiness of students to complete a four year STEM degree. The content focuses on research important to NASA, namely the physical phenomena in unit gravity vs. microgravity for different scientific and engineering processes. Specific topics combined with didactic laboratory classes provide a comprehensive understanding of the underlying theories and experimental techniques utilized in microgravity research. High performing students get the opportunity to participate in the Science and Engineering Scholars component and leverage summer internship opportunities.

- STEM undergraduate curriculum improved in Physics I and Biochemistry courses.

**University of Hawaii: Hawaii’s Engaged STEM Pathways (HESTEMP)**

University of Hawaii, Hawaii’s Engaged STEM Pathways (HESTEMP) creates and establishes engaged and sustainable educational pathways for Hawaii’s underrepresented and underserved students to achieve advanced degrees in the STEM academia. The HESTEMP project developed inquiry-based curriculum modules to educate participants on current NASA topics to include volcanic aerosols, phytoplankton’s influence on ocean color, small satellite technology, planetary landing technologies, unmanned aerial systems, deep space missions, water extraction on Mars soil, and space debris. Matlab software is utilized to formulate simple graphs or animated models to analyze the data obtained from research topics. HESTEMP provides real world examples of the experimental and engineering design processes to help incorporate best practices in learning.

- Higher Education Courses revised:
  - ME 696- Guidance, Navigation and Control (significantly modified, offered at UH-Manoa)
  - ME451- Feedback Control Systems (significantly modified, offered at UH-Manoa)
  - ME651 – Automatic Control Systems (revised, to be offered at UH-Manoa)

- Higher Education Courses Developed:
  - Orbital Mechanics (developed, offered at UH-Manoa, Kapiolani Community College, Moanalua High School)
  - Flight Mechanics (developed, offered at UH-Manoa, Kapiolani Community College)
  - Advanced Topics of Mechanics (developed, UH-Manoa, Kapiolani Community College)

**University of Texas, El Paso: Model for Resource, Reuse, and Active Learning in Interdisciplinary STEAM**
University of Texas at El Paso (UTEP), NASA Glenn Research Center, and a Disney sketch artist developed a Pick-N-Learn (PNL) model for education which uses STEM programming that includes art and reasoning, integrates NASA Education resources, and uniquely engages and impacts students through the use of multi-media storyboards in English and Spanish. The model is vetted for its ability to lead to greater learning outcomes, recruitment, and retention with minority students in STEM PK-12 grades. Over 500 pupils and 150 teachers tested the pilot. The final model will be completed in 2019. The PNL model provides Educator Professional Development (EPD) on incorporating the approach for greater learning outcomes in the classroom. The training platform is expected to transition to an online EPD portal in the future. UTEP hopes to advance the Nation’s STEM education and workforce pipeline by working collaboratively to engage students, educators, and faculty in NASA’s missions and unique assets.

- 846 students directly affected

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

**FY 2018 Annual Performance Indicators**

**API 3.3.3 STEM-18-1:** Provide significant, direct student awards in higher education to (1) students across all institutional categories and levels (as defined by the U.S. Department of Education); (2) racially or ethnically underrepresented students, (3) women, and (4) persons with disabilities at percentages that meet or exceed the national percentages for these populations, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics for a minimum of two of the four categories.

MOO funded 102 student awards with direct significant investment.

**API 3.3.4 STEM-18-2:** Establish NASA's science, technology, engineering, and mathematics (STEM) engagement function, guiding policies, and governance model for operations that will transform the Agency’s portfolio of STEM engagement opportunities.

Not applicable.

**API 3.3.4 STEM-18-3:** Develop a comprehensive performance assessment and evaluation strategy, including measures, processes, and tools that will be used as the foundation for evidence-based decision making.

All NASA MOO activities are required to use independent evaluators to assess the projects impact, execution, and performance. External evaluators meet with NASA’s MOO activity manager at yearly onsite campus visits to communicate qualitative and quantitative data that tracks participant progress and research development through formative and summative feedback.

**API 3.3.4 STEM-18-4:** Release solicitations for all NASA Office of Education-funded programs that are in alignment with the science, technology, engineering, and mathematics (STEM) engagement model and mission directorate priorities.
Not Applicable.

**API 3.3.5 STEM-18-5: Space Grant, EPSCoR, and MUREP investments will contribute to American technical capability through at least 1,200 paper presentations and peer-reviewed research publications.**

Not Applicable.

**ACTIVITY IMPROVEMENTS MADE IN THE PAST YEAR**
(e.g. activity management, cost efficiencies)

- Increase number of participants in each project.
- Increase sustainability of project after awards are completed.
- Increase number of publications from NASA research being conducted.
- Increase number of number of NASA internships, fellowships, and scholarship awards.
- Increase MOO participant exposure through NASA success stories.

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

Oklahoma State University (OSU) leads the consortium of partners from the 13 institutions within the Texas A&M University (TAMU) System, Langston University, OSU Center for Sovereign Nations, Northern Oklahoma College, the Oklahoma 4-H Foundation, and the Technology for Learning Consortium in the mission to collaborate with NASA Johnson Space Center, Agency Mission directorates, and NASA Headquarters to provide competitive and innovative STEM educational opportunities to K-16 students and educators.

**REFERENCES**