

**Activity Name: Minority University Research and Education Program (MUREP) Institutional Research Opportunity (MIRO) FY2014 Annual Report**

**Funding Source: MUREP**

**Relevant Lines of Business: Institutional Engagement**

**Managing Organization: Armstrong Flight Research Center**

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## **Activity Description**

The MUREP Institutional Research Opportunity (MIRO) Activity was first implemented in 1991 as University Research Centers (URC), and as a result of the MUREP consolidation process, is now MIRO. This Activity continues to address the overall goals of MUREP by supporting Minority Serving Institutions (MSIs) in their efforts to provide education, training, and development for students and faculty via the establishment of research centers addressing the NASA mission directorates in aeronautics, science, space technology, and human exploration and operations on their campuses. The appointed PI of each MIRO grantee MSI works collaboratively with their Co-Investigators, faculty, and staff to create a valuable infrastructure that can allow undergraduates and graduate students to focus on obtaining a degree in a NASA related field to include science, technology, engineering, and math. This engagement also develops the competency level of higher education students and further prepares them for careers at NASA, organizations that have an emphasis in NASA related science fields, as well as academia.

NASA provides financial assistance (grants and cooperative agreements) to the Nation's Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs), Tribal Colleges and Universities (TCUs), American Indian and Alaskan Native Serving Institutions (AIANSIs), Predominantly Black Institutions (PBIs) and eligible community colleges. The Administration recognizes the valuable role that these institutions play in educating our citizens, as reflected in the five Minority-Serving Institutions (MSI) focused Executive Orders signed by the President.

NASA's Minority University Research and Education Activity (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 STEM engagement 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 JPL

The MIRO Activity had a total of 13 MSIs active through cooperative agreements spread across the nation with two in California, one in Delaware, one in Florida, one in Maryland, two in North Carolina, one in Puerto Rico, four in Texas, and one in Washington D.C. Over the years, the activity has provided a total of awards to 17 Historically Black Colleges and Universities (HBCUs), six Hispanic Serving Institutions (HSIs), and three institutions classified as an HSI and Asian American and Native American Pacific Islander-Serving Institution (AANAPISI). Active grantees consist of those MSIs that received awards as a result of the last two solicitations, and are currently upon their final project years. This is a critical time in which PIs must work diligently with their institution representatives to develop a plan for sustainability beyond MIRO funding. The grantee institutions have collectively produced numerous outcomes as a result of MIRO funding to include the enhancement of academic programs, creation of products and materials, contributions to research efforts at NASA and partnering organizations and institutions, recognition from professional associations, participation in conference and technical meetings, and a wealth of outreach activities. With guidance from their Technical Review Committee

(TRC), External Advisory Committee (EAC), as well as internal and external institutional partners, the grantees have acquired methods to replicate best practices, extend their reach via capacity building, and explore other funding options through institutional support, grants, contracts, and other vehicles for continuance. Opportunities for future MIRO funding may be available for which some previous grantees may submit proposals in accordance to the solicitation guidance.

### **Activity Goals**

The MIRO Management Office is currently managed out of Armstrong Flight Research Center's Office of Education and is located at the AERO Institute in Palmdale, CA. The management office, along with direction from the MUREP Manager located at NASA Headquarters in Washington D.C., stays abreast of the current governing context to ensure that activity implementation and grantee practices are in alignment with the agency and national priorities. This includes adherence with the Agency Strategic Plan and Committee on Science, Technology, Engineering, and Mathematics priorities, or Co- STEM, as well as the Annual Performance Indicators and NASA Office of Education Multi-year Performance Goals introduced within the 2014 NASA Strategic Plan.

The specific goals of MIRO awards are to:

- Expand the nation's base for aerospace research and development by fostering new aerospace research and technology development concepts;
- Develop mechanisms for increased participation by faculty and students at MSIs in the research programs of NASA's Mission Directorates; and
- Increase the number of undergraduate and graduate degrees awarded to students from MSIs in NASA-related fields.

The specific objectives for MIRO recipients are to:

- Establish significant, multi-disciplinary, scientific, engineering, and/or commercial research centers at the host university, that contribute substantially to the programs of one or more of the NASA Mission Directorates as described in the 2014 NASA Strategic Plan;
- Improve the rates at which students, who historically have been underrepresented in NASA-related fields, are awarded undergraduate and graduate degrees at their respective universities in NASA-related fields; and
- Move increasingly towards gaining support from sources outside of MIRO, by aggressively pursuing additional funding opportunities offered by the NASA Mission Directorates, industry, and other agencies.

MIRO is also specifically designed to address the following NASA Strategic Goal and Objective:

***Strategic Goal 2: Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.***

***Objective 2.4: Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers and faculty in NASA's mission***

*and unique assets.*

### **Activity Benefit to Objective 2.4**

Undergraduate and graduate students, as well as faculty and post-doctoral appointees have received a wealth of benefits as a result of their involvement with the MIRO Centers at their campus. Grantees focus all activities towards preparing students and working with colleagues to improve levels of competency through training, education, and research as a method to build the pipeline for the national STEM education initiatives and workforce.

A review of grantee actions are a representation of the following outcomes listed below.

- There was a total number of 97 publications through proceedings, journals, and books authored by 47 faculty, 43 student, and seven post-doctoral appointees;
- 69 technical presentations were conducted at symposiums, conferences, and technical meetings;
- A total of 14 grant proposals were awarded;
- Six technical transfers were developed;
- 137 student awards were allocated towards internships, stipends, travel, and tuition;
- There was a total of 46 research awards;
- 233 students received fellowships; and
- MIRO grantees collectively conducted outreach for eight administrators, 619 elementary school teachers, 17 high school teachers, 84 graduate students, 56 higher education faculty, and 32 middle school teachers.

### **Activity Accomplishments**

MIRO grantees report accomplishments throughout each fiscal year. The MIRO Management Office was able to identify some notable success stories as listed below.

*Student Accomplishments:*

- A graduate student at Prairie View A&M University used data from the Loma Linda experiments as part of their thesis and gave a talk at the 13th Workshop on Radiation Monitoring for the International Space Station, in Budapest, Hungary during September 2013.
- California State University Los Angeles reported that eight of their students were hired by the Defense Industry.
- Prairie View A&M University's flight project titled 'University Research -1 International Space Station (ISS)' was approved for flight in late 2013 or early 2014. An undergraduate and graduate student was appointed to work with the PI and scientists from Johnson Space Center on radiation measurements for both the flight and a supporting ground based proton experiments.

- California State University Long Beach had seven papers that were accepted for presentation at Human Computer Interaction International Conference in July 2013 located in Las Vegas, NV. Six out of seven of the papers were presented by the University's MIRO supported students.

*PI and Faculty Accomplishments:*

- A faculty researcher at University of Texas at Brownsville was named a fellow of the American Association for the Advancement of Science in which fellows are recognized for meritorious efforts to advance science or its applications.
- The MIRO PI at Howard University attended the joint assembly of the Asia Oceania Geoscience Society and American Geophysical Union in Singapore to promote geoscience and advance its application for the benefit of humanity and in Asia and Oceania. During this time, the PI shared the research development from analysis which resulted from research of MIRO funding.

*Education and Research Accomplishments:*

- The PI along with one doctoral student at Delaware State University's MIRO Center served as members of NASA's Mars Science Laboratory ChemCam Instrument Development & Science Team and which received the 'Group Achievement Award'. The ChemCam team received this award on July 18, 2013 for exceptional achievement defining ChemCam's scientific goals and requirements, developing the instrument and investigation, and operating ChemCam successfully on Mars. This NASA Honor Award is presented to a number of carefully selected teams who have distinguished themselves by making outstanding contributions to NASA Missions.
- Morgan State University has extended its educational programming below the undergraduate college level to ensure that students have an opportunity for the highest levels of academic achievement. The grantee supports a fully integrated pipeline from 7th grade through the doctoral degree. Pipeline activities include: Cultivating Adolescents in Systems Engineering Habits (CASH) (Middle School); Summer Institute for Robotics (SIR) (High School); Pre-Accelerated Curriculum in Engineering (PACE) (Incoming Freshmen); and Innovative STEM Conference (ISC) (Undergraduates and Graduates).
- During FY2013, the MIRO Center at Florida International University was able to enhance the academic programming and curriculum at its institution. This includes the establishment of new core graduate courses in ecohydrology related subjects, a new Ph.D. program track in Biogeosciences, and a new Ph.D. program in Environmental Science, Policy, and Management.
- North Carolina Central University's metallic thin film with nanostructures for IR applications project received \$330,000 in funding from the U.S. Army Research Office from FY2013 through FY2016.

- Texas Southern University was able to get the following patent awarded: Enzymatic nucleic acid synthesis: compositions and methods for inhibiting pyrophosphorolysis.

### **Activity Contributions to API Measures & Co-Stem Priorities**

The following demonstrates the contributions that the MIRO Activity has made towards the measures provided below.

- ***Annual Performance Indicators:***
  - **ED-14-1: 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.**

The MIRO activity reported the following for grantees who made awards to those students classified within the categories presented in the paragraph above.

- 134 student awards were made to female students
- 118 Black or African American students received student awards
- 137 Hispanic or Latino students received student awards
- 34 student awards were made to students identified as Asian
- 8 Mobility or Orthopedic Impairment students received student awards
- 2 American Native or Alaskan American received student awards
- **ED-14-6: 250,000 educators participate in NASA-supported professional development, research, and internships that use NASA-unique STEM content.**

Grantees of the MIRO award were able to report that they were able to serve the following number elementary and secondary teachers per each activity described below.

- In addition, a total of 37 elementary school teachers, eight high school teachers, five informal educators, and 26 middle school teachers participated in STEM engagement activities with a MIRO grantee. These numbers are indicators to show the extended reach in which elementary and secondary students will be impacted via instructors and teachers who were engaged in NASA STEM activities.
- A total of four high school teachers and 28 middle school teachers were also reported as participants of STEM engagement.

- **ED-14-8: One million elementary and secondary students participate in NASA STEM engagement activities.**

In addition to the grantee institutions focus on efforts within higher education, the grantees also reported a variety of STEM outreach activities they conducted for elementary and secondary students as presented below.

- Grantee institutions were able to report a total of 24 exhibit activities and 66 student hands-on Informal STEM Education activities for the following students: 590 elementary school students, 1,125 middle school students, and 371 high school students.
- MIRO grantees also reported STEM engagement activities through a variety of pre-college activities for the following students: 436 elementary school students, 504 middle school students, and 945 high school students.

- ***Co-STEM priorities as quoted from the Federal Education STEM 5-Year Strategic Plan:***

- **Enhance STEM Experience of Undergraduate Students: Graduate one million additional students in STEM fields over the next 10 years.**

The MIRO Management Office was able to identify numerous contributions towards the enhancement of undergraduate student STEM experience amongst the grantee institutions which included the following.

- NASA-Sponsored Student Opportunities
- Faculty/Researcher/Enhancement Support
- On-Site University Research Support
- On-Site Industry Experience Support
- On-Site NASA Center Experience Support
- Faculty/Researcher Travel Support
- Conducting of Conference/Workshop/Symposium Support
- Partnership Collaboration Development Support
- Faculty Recruitment Support
- Partnership Collaboration Development Support

Overall, there were 267 instances of higher education student research engagement identified across the grantee institutions.

- **Better Serve Groups Historically Underrepresented in STEM Fields: Increase the number of underrepresented minorities that graduate college with STEM degrees in the next 10 years and improve women's participation in areas of STEM where they are significantly underrepresented.**

The following represents the number of students identified as underrepresented minorities that received a significant investment from MIRO at the grantee institutions.

- 134 student awards were made to female students
  - 118 Black or African American students received student awards
  - 137 student awards were made to Hispanic or Latino students
  - 34 student awards were made to students identified as Asian
  - 8 Mobility or Orthopedic Impairment students received student awards
  - 2 student awards were made to students identified as American Native or Alaskan American
- **Design Graduate Education for Tomorrow's STEM Workforce: Provide graduate-level trained STEM professionals with basic and applied research expertise, options to acquire specialized skills in areas of national importance and mission agency's needs, and ancillary skills needed for success in a broad range of careers.**

Students who received student awards or a significant investment from MIRO are exposed to a wide range of research and education activities. The grantee institutions also involve additional higher education students and faculty in these activities.

The following demonstrates how MIRO has contributed towards graduate level training and program design for the STEM workforce of the future in addition to those students receiving a significant investment from MIRO.

Number of students and faculty engaged in research activities:

- 13 undergraduate students
- 13 graduate students
- Four pre-service teachers
- 59 higher education faculty
- Six post-doctoral appointees

Number of students and faculty engaged in higher education activities:

- 193 undergraduate students
- 205 graduate students
- 10 pre-service teachers
- 82 higher education faculty
- Eight post-doctoral appointees



## **Activity Improvements Made In the Past Year**

The MIRO Management Office continues to work collaboratively as a partnership through a cooperative agreement between Armstrong Flight Research Center and the AERO Institute. The partnership allows support from two AERO institute staff members as well as procurement efforts towards funding for supplies, materials, activities, travel, and special meetings.

Needs for improvement in grantee oversight and monitoring efforts have been identified and incorporated into tasks and responsibilities. This has required more regular communication between the NASA Shared Services Center, the MUREP Manager, and the AFRC Resource Analyst. This has allowed management staff to have more awareness of grantee performance documentation, budget status, and grantee no-cost extension processes. This awareness assists MIRO Management Staff with being able to develop effective communications with grantees and preparing requests for action to ensure compliance.

Although MIRO grantees are currently within their final project years of their performance period, many have taken the opportunity to explore options in contracting as evident with University of Texas at El Paso and Morgan State University. Conversations surrounding contracting opportunities via the NASA Mentor Protégé Program and Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) have occurred, and resources pertinent to these opportunities will be communicated to the grantees.

## **Activity Partners & Their Roles in Activity Execution**

Awardees of MIRO have consistency in establishing and maintaining relationships with partnering organizations, institutions, and federal entities to support project execution and facilitate collaborative projects. California State University Long Beach continues to work with Boeing to employ student interns and has developed a stable relationship with NASA Ames Research Center in which student interns provide support to the Flight Deck Display Research Laboratory. University of Texas at El Paso (UTEP) was awarded more than \$2 Million in funding from the U.S. Department of Defense, U.S. Department of Energy, and the U.S. Department of Education to continue their efforts of NASA research. In addition, UTEP has retained stable relationships with NASA Johnson Space Center, White Sands Testing Facility, Blue Origin, and the Morpheus Team in order to maintain program operations. In addition, the PI of Delaware State University along with one graduate student was able to collaborate with Jet Propulsion Laboratory on the Mars Rover Collaboration. The following represents a snap shot of partnership entities for the MIRO grantees institutions who assisted with student development, research infrastructure, faculty engagement, as well as other attributes as a result of the MIRO award.

***Majority Institutions:*** *Duke University, Princeton University, John Hopkins University, Notre Dame University, Northwestern University, and University of Denver*

***Federal:*** *U.S. Department of Energy, Army Research Office, Sandia National Laboratories, National Renewable Energy Laboratory, and Los Alamos National Laboratory*

***Non-Profits:*** *AERO Institute, American Meteorological Society, Harris Foundation, San Jose*

*State Foundation, Science Teacher Association, and Delaware Aerospace Education Foundation*

## **References**

NASA Office of Education Performance Management System (OEPM) (2014). Retrieved 2015.