

Minority University Research and Education Programs
(MUREP) Small Programs (MSP)
Administered by (Multiple Grantees)
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PROJECT DESCRIPTION

Minority University Research and Education Project (MUREP) strives to enhance the research, academic, and technology capabilities of Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs), and other Minority Serving Institutions (MSIs). Multiyear grants awarded to MSIs assist faculty and students in research pertinent to NASA missions. MUREP Small Projects (MSP) is an umbrella term for minority science, technology, engineering, and math (STEM) education initiatives that are part of NASA's MUREP portfolio. MSP funds innovative STEM projects that address NASA's MUREP priorities, with an emphasis of identifying gaps or areas where funding of these innovative projects will enhance the Higher Education portfolio and strengthen its ability to meet Agency objectives.

PROJECT GOALS

MSP's goal is to fund innovative, short term and high risk STEM projects that address NASA's MUREP priorities. As funding is available (based on HQ budget and existing MSP portfolio of projects), MSP will release solicitations targeting specific MUREP portfolio needs. The project focuses on recruiting underrepresented and underserved students in STEM disciplines through completion of undergraduate or graduate degrees in support of their entry into the scientific and technical workforce. MSP solicitations will state the education PART/APG measures to be addressed by the proposals. The proposals will be evaluated and funded based on how effectively they meet these objectives while leveraging other existing NASA education projects, external funding sources or external partnerships. MSP is intended to provide initial funding of these projects for a specified term while they strengthen and transition to other funding sources. Recurring funding of projects is not expected, but may be limited to projects meeting critical Agency needs, and with exemplary performance assessment.

PROJECT BENEFIT TO OUTCOME (1, 2, OR 3) and NASA Annual Performance Goals (APGs)

All MSP goals and objectives are designed to support the Agency's Strategic Plan and the NASA Education goals, specifically, Outcome 1 Higher Education, and map directly to four of the new

FY12 APGs. Outcome 1 contributes to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals, through a portfolio of investments.

PROJECT ACCOMPLISHMENTS

Achieving Competence in Computing, Engineering, and Space Science (ACCESS):

ACCESS provides students a 10-week paid internship at NASA centers around the United States. It is designed for undergraduate and graduate students with disabilities who have strong backgrounds in science and a desire to pursue technical careers. Undergraduate students are provided a stipend of \$5,250 and the graduate student stipend is \$6,000. In addition, travel expenses are paid, up to a \$1000 allowance. There is a provision for assistive technology and other reasonable accommodations. Since 1996 AAAS referrals to ACCESS have resulted in 265 students being hired as NASA interns. Eighty-five of these students are pursuing or have earned a graduate degree in their major and 44 students are currently pursuing undergraduate degrees. More than 120 student interns have secured full employment in a technical field.

In 2012, HQ mandated that student intern projects could not recruit nor hire new students. Therefore, ACCESS was limited to providing internships only for returning NASA students with a disability. Due to this limitation, 15 student interns were placed at 7 NASA centers, including Headquarters. Eleven were undergraduates and four were graduate students, three were women, seven were racial or ethnic minorities and at least 10 different disabilities were represented in the group.

ACCESS has placed 265 student interns with disabilities at NASA since 1996, when NASA awarded the first grant to AAAS. Longitudinal data indicate that 90% of ACCESS alums have pursued graduate studies and/or have found full employment in science, technology, engineering, or mathematics (STEM) fields. The most recent data shows that, since 1996:

- 265 students have participated in ACCESS internships,
- 64 (24%) of ACCESS alumni were identified as underrepresented minorities,
- 73 (28%) of ACCESS alumni are women,
- 79 (30%) of ACCESS alumni have returned to NASA for multiple internships,
- 17 ACCESS alumni have been hired at NASA,
- 12 ACCESS alumni have done co-ops at NASA installations,
- 3 ACCESS alumni have worked for NASA contractors,
- 91 ACCESS alumni are pursuing, or have received Master's or Ph.D. in a technical field,
- 36 ACCESS alumni are pursuing, or have received, undergraduate degrees,
- More than 121 ACCESS alumni have reported they are working in a technical field, and
- 12 ACCESS alumni have reported they are working in other fields.

Current Three Year MSP Projects:

A solicitation in FY09 for new innovative projects generated 39 proposals, with five selected for implementation starting in FY10. These projects are three year awards, with funding renewals based on project performance and funds availability. Evaluation and sustainability were key criteria in the awards, as well as innovation.

New Mexico State University (NMSU): Promoting Access, Retention, & Interest in Astronomy

New Mexico State University (NMSU) is one of the two primary universities in New Mexico and its branch campuses serve fifty percent of the 62,000 undergraduates state wide. NMSU is also a Hispanic-Serving institution, therefore meeting the needs of underrepresented students. NMSU student body is 55% female and about 50% percent ethnic minority therefore resulting in a customer base that is 78% historically underrepresented and underserved students.

The project purpose of NMSU is to develop a set of critical resources for use in traditional and distance learning undergraduate introductory astronomy courses. The NMSU online interactive astronomy material provides students the opportunity to develop their science skills in a private, non-threatening, self-directed learning environment. The new astronomy materials will address two key needs in increasing success for underrepresented students in New Mexico: providing a mechanism for students to review basic math and science and allowing students to explore current astronomy topics at a pace commensurate with their skills. The new materials will also allow students whose work and family commitments limit their ability to attend in-class sessions to successfully pursue an accredited laboratory-based science course and mandatory graduation requirements.

The new materials being implemented will directly improve the scientific training for pre-service teachers, who comprise 40% of class membership thus improving the K-12 educational experience in the local underrepresented and underserved population. These new materials will improve retention rates for students with limited math and science backgrounds. The statewide science credit requirement recently doubled, so increasing access to laboratory science courses in a 24/7 mode removes a major barrier to completion of a college degree. The new online materials will also include an instructor analysis tool for reviewing student self-review work, containing trends with topic and time for individuals and groups.

NMSU received additional university funds in FY10, and was therefore able to increase the complexity of the computer simulations and usage of NASA images and spectroscopy in the lab exercises, while reducing their request for FY11 funds. They have also increased the number of lecture modules to be created. Students with English as a second language have cited the database as a productive tool for strengthening their background knowledge of the sciences, which is a critical need in New Mexico.

The database contains instructor analysis tools for reviewing student self-review work, trend data for individuals and groups, and records of each exercise completed by every student. This allows instructors to monitor individual and group progress, tracking every facet of student action including incorrect answers, as well as the global response to individual topics of study.

The program contains four components, based on 26 lecture modules starting with exploration of the solar system and ending with the cosmology of the early universe, in conjunction with online text, and over 5,000 images derived primarily from existing NASA astronomy and space exploration missions. Over 88% of lecture modules contain NASA data, while the remaining 12% of lectures develop basic material congruent with NASA education goals. Seven platform-independent web applications have been constructed for dissemination and use of the materials. In addition, a series of 13 short films highlighting members of underrepresented groups with productive careers in astronomy-related STEM fields are being created, which will reinforce a message of inclusion for underrepresented students in the future STEM generation and combat stereotype bias. These videos were also requested for use at the National Radio Astronomy Observatory (NRAO) website and the visitor center at Arecibo Observatory in Puerto Rico, with Spanish subtitles.

The success of the course led directly into the creation of a full distance education mode for the course, due to the now very high demand for the course. The demand for these distance education courses is unprecedented, far higher than that for any other astronomy course at the university. All spaces were claimed within two hours of the beginning of general enrollment, and the instructor has been besieged by a steady stream of plaintive requests for over-rides ever since over each Summer season. There were 25 undergraduate participants in Fall 2011, all distance learning students using the materials in a general education astronomy course to fulfill requirements for a B.S. degree. Of the Fall 2011 students, 58% were under-represented or under-served and 59% were female. Another 26 distance learning undergraduate participants are participating in Fall 2012. In contrast, in-class versions of the course remain open from May through August, with the last spaces not being taken until the first week of Fall classes. It is clear that with these courses we are creating an educational opportunity for students, which is in great demand, and of great utility to them.

NMSU's five campuses work with every county in New Mexico, and distance education partnerships with Eight Northern Indian Pueblos Council (ENIPC) tribal colleges create yet another pipeline for dissemination to populations statewide. The self-contained, non-proprietary, fully self-explanatory online materials can be used by external instructors without significantly increasing upkeep. In Fall 2011 and Fall 2012, a professor at New Mexico State University and a professor at Humboldt State University used the materials to teach their own undergraduate astronomy courses. They have also fielded inquiries from interested instructors at several additional universities throughout the United States (including Creighton University, Lafayette College, the College of San Mateo, Dona Ana College, and New Mexico Tech), and in Canada (Waterloo University). The New Mexico Space Museum has also asked to utilize our laboratory exercise materials as a part of their outreach efforts.

To encourage the students who most needed to study more, the class homework grades were tied explicitly to the quality and amount of review work done within the library. The results were very positive. Students at lower quiz scores increased the amount of review work done before taking weekly quizzes to match (and for the weaker cohort, to even slightly exceed) the top students. For the weakest cohort, the amount of review homework that was done tripled. The overall average amount of time spent in review per student increased from Year One, and, most

importantly, the increase was due to the changed behavior of the weaker students in the class, those who would benefit most from additional time spent in study.

NMSU is seeking funds to expand this program to include the general public, via educational applications and the creation of courses specifically to meet the needs of Pre-Service Teachers.

North Carolina Agricultural and Technical State University (NCA&TSU): Integrating NASA Science, Technology and Research in Undergraduate Curriculum and Training (INSTRUCT)

The mission of NASA requires STEM content that includes the bio-chemical sciences, physical sciences (earth and atmospheric sciences), engineering and mathematics. This project will develop, implement, evaluate and disseminate innovative pedagogical concepts for integrating the associated NASA STEM content into the related courses at NCA&TSU. NCA&TSU is the number one producer of African-American BS and PhD graduates in engineering, and ranks number five nationally in the percentage of women awarded Bachelor's degrees in engineering. The courses that have been chosen for inclusion in the project are large enrollment courses that are critical to undergraduate STEM student success and provide opportunities to incorporate NASA content to motivate student engagement and success. An interdisciplinary team of faculty members are leading and coordinating the integration efforts, impacting the undergraduate curriculum in the fields of Biology, Physics, Chemistry, Mathematics and Engineering. The primary targeted audiences are undergraduate students in these disciplines, with the ultimate goal of increasing interest through real world data and examples and thereby increasing the retention of these students in STEM fields. These courses are large enrollment courses that are critical to undergraduate STEM student success.

In FY10 and FY11, seven courses were revised, and opened to student enrollment starting in Fall 2010. The integration of NASA content into the chosen courses has impacted approximately 300 students through enrollment in the classes, with a large segment of underrepresented students. In FY12, the effort focused on the replicability and sustainability within NCA&TSU of the selected sections of specific undergraduate courses taught by the interdisciplinary team of faculty investigators during the first and second year. To facilitate wide dissemination of the materials developed, module booklets and modern educational technologies are being utilized.

Listed below are some of the project innovations that were achieved during the FY12 implementation of the project:

- All modules that were developed based upon STEM education research and best practices were implemented in various undergraduate courses during the third year.
- An interdisciplinary team approach was utilized that allowed NASA content to be incorporated into biology, physics, chemistry, mathematics, atmospheric science, and engineering courses.
- Four new models: biochemistry module, chemistry module, mathematics module and atmospheric science module were developed and one of them (biochemistry module) was implemented in undergraduate curriculum.

- Continued use of modern educational technologies (virtual self-study modules and exercises, web based tutorials, other techniques such as Magic Planet presentations) were used to communicate NASA research data.
- NASA INSTRUCT students/faculty assisted in Student Spaceflight Experiment Program for K-12 students. This is the first time the NASA INSTRUCT program initiated participation of K-12 teacher-student summer trainee program in materials module.
- New research initiative in the area of space radiation shielding materials was launched in collaboration with National Institute for Aerospace (NIA), Hampton, Virginia and NASA Langley Research Center.
- NASA-INSTRUCT program was leveraged to get funding from various agencies including NSF and Clarkson-Aerospace.
- The initial analysis for year 2 for students retained by course where modules were offered indicates that student retention was greatest for MATH 132 008, MATH 431 005, and MEEN 460 001 in the fall semester, with retention averages ranging from 92% - 100%. For the spring semester, retention averages were highest for MATH 431 004 and MEEN 460 001. Overall retention was 85%.

All the modules developed in Year 1 and 2 of the project were offered again in Fall 2011 and Spring 2012 semesters, impacting 378 undergraduate students. In addition four new modules were developed: one in the area of freshman chemistry, second in the area of biochemistry, third in the area of earth and atmospheric sciences and fourth in the area of mathematics.

During this time period, 11 students, including four graduate students, worked on various NASA INSTRUCT modules with nine faculty members. All of these students received significant funding from the program. These students not only helped to develop modules, but also helped to perform assessment of the modules in various STEM related courses mentioned in Table 1. We continuously monitored their academic progress and their retention information is reported in the retention section.

During Year 3 of the project, two assessment forms were used which were developed and tested out in various STEM related courses in year 2. The assessment involved two parts, pre survey and post survey. Six modules; Weather and Climate module, Biology module, Materials module, Chemistry module and Mathematics modules (2) were assessed using these assessment tools.

Florida A & M University (FAMU): Minority Innovation Challenges Institute

MICI, operated by FAMU, mentors students at MSIs across the country by providing technical sessions to generate participants in the STEM technical competitions sponsored by NASA. Unfortunately, the trend has been that there is little participation by MSIs in most of the NASA challenges. In less than 2 years, FAMU has significantly changed this trend. MICI is delivered in the format of a year-round virtual conference. Registration is free and open to any student currently enrolled in a STEM major. The virtual conference features live video presentations from technical speakers, powerpoint presentations, Q&A sessions, a discussion board, exhibit booths, and the ability to view archived content. MICI focuses on a different NASA technical competition each month. During the final year of this grant, those students who participated in

MICI will be invited to participate in a virtual job fair hosted within the existing virtual conference infrastructure. NASA, along with NASA contractors, would be invited to make presentations, occupy a virtual expo booth, and could connect with these future workforce candidates via video, audio, or text chat.

FAMU launched its first broadcast on May 24, 2010. Since then, 1061 have registered in MICI. These 1,061 students are comprised of 770 classified as underserved and underrepresented (including females). The registrations represent a total of 425 different universities, including 126 MSIs. In addition, a total of \$10K was provided for direct student support for 6 FAMU students to assist in development of the project.

MICI has produced over 50 content sessions, including a video message from NASA Administrator, Charles Bolden, NASA internships, and grants for technical competitions. Some of the different competitions and challenges include: Space Elevator Competition, Strong Tether Competition, Lunabotics University Student Launch Initiative, The Great Moon Buggy Race, ESMD Systems Engineering Paper Contest, SpaceTech Engineering Design Contest, the Green Aviation Engineering Challenge, and the Reduced Gravity Education Flight Program.

MICI has also expanded efforts to assist NASA's OSSI SOLAR and NASA's Student Programs Office with recruitment of interns and Co-Ops. During the summer of 2012, 46 MICI students were accepted into NASA's internship program, and were placed at all 10 field Centers.

- 39 classified as underserved and underrepresented (85%)
- Seven students were also accepted into the 2012 Co-Op program, with five classified as underserved and underrepresented (83%)
- Students accepted into 2012 Summer Internship and Co-Op programs are from 45 different schools.

By playing a more aggressive role in the recruitment of MSI teams into NASA challenges, MICI provided \$4,000 grants to first time MSI competitors. Through a competitive application process, the following MSIs were selected for the corresponding competitions to offset costs for equipment and team travel. Each selected team faculty was also required to create either a Senior Design or Special Projects Course.

- NASA Lunabotics Mining Competition
 - Florida International University
 - Morgan State University
 - Texas A&M International University
 - Texas A&M University Corpus Christi
- University Student Launch Initiative (USLI)
 - California State Polytechnic University, Pomona
 - New Mexico State University
- Intercollegiate Rocket Engineering Competition
 - Haskell Indian Nations University
 - Howard University
 - Navajo Tech College
 - Virginia State University

The FAMU Rocket Team won the altitude award at this year's NASA USLI. This award is given to the rocket that gets closest to a mile, preferably without going over. FAMU's rocket reached 5270 feet (1 mile = 5280 feet). In the history of the contest, this is the closest a rocket has come to a mile without going over. FAMU created a one hour course for FAMU USLI participants.

The MICI evaluation plan has been created by Dr. Jeanne Diesen, an expert who has experience in evaluating NSF, NASA, and State of Florida educational programs. The plan will include collecting data to (1) satisfy designated NASA Metrics, (2) make available information to better inform the project, and (3) provide continuous feedback about the program. A student tracking system along with a series of surveys and follow-up telephone interviews will be used to gather data. All instruments will be developed in accordance with best practices for instrument development.

Sistema Universitario Ana G. Mendez (SUAGM): Engaging MSI STEM Students through Space-Based Capstone Design

Three Hispanic-Serving Institutions (HSI) in Puerto Rico, namely Universidad del Turabo (UT), the lead institution, Universidad Interamericana-Bayamon (UIAPR), and Universidad Politecnica de Puerto Rico (UPPR), have collaborated with Michigan Technological University (MTU) to develop Systems Engineering based multi-disciplinary capstone design courses. This will impact a minimum of twelve engineering programs (four per institution), incorporating NASA sponsored research and projects. This project encourages the implementation of Capstone Engineering Design courses that teach students a structured, yet agile design process that supports the integration of increasingly diverse and high-risk systems, while meeting the ever-prevalent low-cost requirements.

This project leverages expertise from an existing NASA Exploration Systems Mission Directorate (ESMD) funded senior design course developed by MTU and addresses a key NASA need for engineering graduates with design knowledge and experience using a systems engineering approach. The main goal of the project is to develop new capstone design curricula that better prepares students to be successful in multi-disciplinary teams performing complex systems design projects. The systems engineering approach and the capstone design class are becoming fundamental to senior students to improve their potential of a successful engineering career. The new capstone design curriculum will enable students at each institution a richer design experience that better prepares them for the systems-based design teams employed by NASA and the aerospace industry. This project targets students in many departments at these HSIs with nearly 100% underrepresented and underserved Hispanic students in STEM disciplines. The program will be initially developed at the three HSIs, and then project results will be disseminated to MSIs nationwide.

The project entails a multi-prong approach, including the implementation of a NASA course in systems engineering-based, multi-disciplinary, capstone design; a summer program to develop student project team leaders; support for NASA capstone projects as one way to achieve the goals of ABET-accredited capstone design programs; advocating and supporting proposals for NASA summer opportunities for students as a means to gain real world experience; the development of university cohorts to gain efficiencies in curricular planning and faculty training,

as well as to foster long term collaboration across the universities; and the development and dissemination of a capstone design assessment process that is grounded in best practices.

There were 23 students participating in the Leadership Workshop at Michigan Tech, four more than last year. The distribution of students per gender and internship type is:

- Students Internship Distribution
 - Michigan Tech
 - 7 Males
 - HSI Internships awarded by NASA-MUREP
 - 1 Female
 - 6 Males
 - HSI Internships awarded by other Projects
 - 1 Female
 - 3 Males
 - Federal Government
 - 1 Male
 - TOTAL
 - 2 Females
 - 17 Males
 - 19 Total

A total of six programs at the three HIS universities implemented the systems engineering in their curricula, mainly in the capstone design courses. In spring 2012, a Michigan Tech PI interviewed the participating SUAGM faculty to document the successes and the challenges associated with implementation. Following are some of the results:

- Students like the structure and clarity of expectations when using this type of design process.
- Faculty like the flexibility of the modules, being able to choose the most relevant to their courses.
- The common design process facilitates multi-disciplinary projects.
- Challenges include:
 - The level of implementation depended greatly on individual faculty (their backgrounds and degree of buy-in).
 - For some of the majors, industry is not a good source of rich design projects.
 - Teaching of a structured design process comes too late in the curriculum; as a result, at least two of the programs are looking at design process to add content to earlier classes.
 - The examples that go with modular materials are most useful for mechanical engineering courses; some additional examples from other disciplines should be developed.
 - The common assessment process at the three schools was only partly implemented, because the process does not match the different existing ABET assessment processes particular to each school.

The website <http://www.systemsengineeringcapstonedesign.info/links.aspx> was developed in order to disseminate the project and impact more students who have not participated in any workshops and want to use the systems engineering concepts with their capstone projects.

Of particular note is the fact that improvements made to UIAPR's capstone courses helped the UIAPR's engineering programs during ABET accreditation visit last fall. Previous visits had noted that improvements were needed to maintain accreditation.

Navajo Technical College (NTC): Laser Scanning for Digital Manufacturing Project

Rapid prototyping skills are needed by the engineering directorate at several NASA facilities and internship opportunities were required at Marshall Space Flight Center (MSFC), specifically in the National Center for Advanced Manufacturing's Rapid Prototyping Lab.

In order to create simulations of the manufacturing process, the MSFC team needs as-built models of facilities which are most efficiently and accurately captured by laser scanning, which MSFC does not currently have the capability to create. NTC will integrate the capturing and processing of the digitally captured data as a part of coursework, which will allow students to gain the hands-on knowledge highly valued by NASA. NTC has revised numerous courses (greater scope than anticipated) to incorporate rapid prototyping and laser scanning technology, improving the ability to provide NASA with the current level of skills needed by the NASA digital manufacturing team. The courses have a relationship to digital manufacturing, manufacturing engineering, quality control, statistical comparison, engineering and design.

Directly as a result of the MSP funding, NTC is now able to offer a new Bachelor's of Applied Sciences (BAS) degree, successfully converting them from a 2 year community college to a 4 year university. Spring 2011 was the first semester that enrollment was opened to students. The degree was developed by NASA funding and is a IT based degree, with three focuses for students to chose from including; Computer Science, Digital Manufacturing, and New Media. Beginning enrollment for each was ten students on the Computer Science track, nine students on the Digital Manufacturing, and five students on the New Media track. All of these students except for one are from the underserved and underrepresented student groups.

Current numbers for FY12 are:

- 27 students in the CAD program
- 12 students in the Digital Manufacturing, BAS program
- 58 students in the Computer Science, BAS program
- 17 students in the New Media, BAS program
- 17 students in the Industrial Engineering, BS program (Industrial Engineering is mentioned because this program was developed as a direct result of the grant success and funded by NSF.)

NTC enrollment is now nearly 1800 students (nearly a 600% increase since 2006). Student interest and retention in the program has increased dramatically because of the internships,

hands-on-projects, and student support available by NASA funded opportunities. NTC is currently ranked in the top 120 community colleges in nation by Aspen Institute.

The **Navajo Tech Center for Digital Technologies (CDT)** was developed to enhance the students' educational experience as well as to provide funding for the participating programs. The objectives for the Center is to attract contracts from various government agencies and private industry in the areas of Rapid Prototyping, 3D modeling, 3D laser scanning services; to provide internship opportunities for students – both full time and part time; to provide applications for future research in materials, in-process inspection and laser scanning standardization. The Center will expand services to include GIS services, IT services (data storage, web hosting, programming), and expanded manufacturing capabilities (CNC machining, micro machining services). The Center will also provide educational outreach to Navajo Nation K-12 schools to introduce students to engineering and manufacturing. Next steps include program expansion to the two NTC instructional sites in Chinle AZ, and Teec Nos Pos, AZ.

Current long term vision for NTC with project funds and other leveraged grants:

- *2012-13*
 - Set up robotics infrastructure
 - Purchase small robot (this can either be a motoman for material handling or combine with scanning for inspection and purchase a robotic/virtual inspection software- first option ~\$30,000 - second option - pushing \$75,000)
 - Implement AAS BIM program
- *2013-14*
 - Create partnership with the industrial engineering program for projects in design, rapid prototyping, simulation, cad modeling...
 - Expand infrastructure (IT, storage, servers)
- Phase IV 2014
 - The CDT plans to open its regional center in 2014, serving McKinley County and providing introduction to rapid prototyping as well as laser scanning technology to the high schools on and around the Navajo Nation. This will include small RP machines that will enable the machines to be dropped off for student use. Planning is ongoing for other innovative projects and research, especially those that include paid internships for students.
- Phase V 2014-2015
 - Cutting edge research and development will focus on nanotechnology and metal freeform fabrication (additive manufacturing).
- *2015-16*
 - Future development includes a 4-year construction management or BIM specialist which will include how to create BIM for architectural, engineering and

construction purposes. This will tie into construction costs and timeline, inspection and verification, and building management.

- 2016-17
 - Implement 4-year curriculum - 2+2 program with the AAS.

A NASA CIPAIR grant was awarded that lends further support towards developing the full educational program. Curriculum development that supports integrating entrepreneurship into classroom activities by linking student projects to real-life industry needs is underway. Currently, the following outreach activities are underway:

- Student recruiting and retention will remain top priorities through dual enrollment to engage high school students in CAD and the fundamentals of engineering to recruit for the 4 year digital manufacturing program offered at NTC.
- A strong effort through visiting high schools will be made to let the Navajo Nation High Schools and the Navajo Nation know what NTC has to offer in STEM opportunities.
- Presentations on Laser Scanning have been made to middle school students at Fort Defiance and to high school students at Crownpoint High School.

PROJECT CONTRIBUTIONS TO PART MEASURES

MSP projects support Outcome 1 of the NASA education portfolio:

- **Outcome 1 (Higher Education):** Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goal through a portfolio of investments.
 - Achieve 40% participation of underserved and underrepresented (in race and/or ethnicity) in NASA higher education projects.
 - Achieve 45% participation of women in NASA high education projects.
 - 75,000 educators participate in NASA education programs.
 - 25,000 undergraduate and graduate students participate in NASA education opportunities.

ACCESS provided 15 internships in FY12 for students with disabilities who are seeking a STEM major, for 11 undergraduates and 4 graduate students. ACCESS is currently the only project in the NASA education portfolio directly serving disabled students.

NMSU – Enrollment is at full capacity for the course at NMSU, in addition, the course was offered at Humboldt State University.

SUAGM - Student direct support was provided for 30 students, for a total of \$35K in student awards, and \$30K, for student competition teams. In addition, over 300 students were enrolled in the senior design capstone courses.

NCA&TSU - Student stipends totaled \$31K for 9 students. All the modules developed in Year 1 and 2 of the project were offered again in Fall 2011 and Spring 2012 semesters, impacting 378 undergraduate students.

NTC - Student stipends and internships were provided for 11 students, for a total of \$74K. A total of 30 students were enrolled in the revised courses.

FAMU – A total of \$10K was provided for direct student support for 6 students.

SIGNIFICANT ACCOMPLISHMENTS

- All MSP projects are on budget and on schedule; some have increased scope with no additional funds request.
- In FY12, a total of six innovative and unique projects were funded and managed by the MSP project manager. In addition, MSP continues to provide support for various HQ initiatives, such as the Education Opportunities In NASA STEM (EONS) solicitation.
- Despite a limitation for no support for new students, ACCESS placed 15 returning student interns at NASA centers in FY12.
- A total of over 1060 students are registered in MICI, with 770 students classified as underserved and underrepresented. Mini-grants for participation in NASA competitions totaling \$40K were awarded to 10 MSIs. MICI has also expanded efforts to assist NASA's OSSI SOLAR and NASA's Student Programs Office with recruitment of interns and Co-Ops. The FAMU Rocket Team won the altitude award at this year's NASA USLI.
- The use of a mini-grant competition for FAMU MICI exceeded all expectations, generating 10 brand new MSIs participating in NASA challenges for FY12. The three new MSI participants from FY11 will also compete again in FY12. There has historically been little participation by MSIs in the NASA challenges.
- NCA&TSU has secured additional funding from the state of \$100K per year, in addition to the NASA funds.
- NMSU secured an additional \$95K of funding from the university, enabling them to increase the scope of the project. The incredible success of the curriculum led directly to a full online class being developed, at no additional cost to NASA. A partnership with another university has clearly shown the scalability of the project. In addition, a series of 13 short films highlighting astronomy-related STEM fields are being created, reinforcing a message of inclusion for underrepresented students, with requests for use of the films by external partners.

- SUAGM is performing above scope at no additional cost to NASA. This includes the training of more faculty than anticipated, more course revisions than expected, and funds availability for student competitions to reinforce the concepts learned in the classroom. In addition, improvements made to UIAPR's capstone courses helped the UIAPR's engineering programs during ABET accreditation visit last fall.
- NTC is phenomenally above scope with an anticipated 600% increase in enrollment for the courses directly impacted by the end of the third year, and an overall 300% increase in NTC enrollment. This is directly due to MSP funds, which initiated the change from a 2 year college to a 4 year university. In addition, Navajo Tech Center for Digital Technologies was created, generating the development of economic funds through contract work, including a \$130K contract agreement for FY12.

PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

For FY12, the following is a list of project partners in the implementation of the MSP projects:

- ACCESS: Principle Investigator: The American Association for the Advancement of Science (AAAS), responsible for student recruitment, selection, reasonable accommodations and stipend payment.
- For Navajo Technical College (NTC), partnerships have been created with Marshall Space Flight Center (MSFC) and Ames Research Center (ARC). Advisory Board members include National Center for Advanced Manufacturing – Louisiana Partnership (NCAM-LP); Navajo Tribal Utility Authority; Sandia National Labs; SPAR Point Group, Diversified Business Communications, SPAR, LLC; WHPacific, Inc. NTC is also working closely with the National Institute for Standards and Technology (NIST), to implement the development of the CAD Center as a center for non-destructive evaluation with optical measurements and advanced digital manufacturing. To ensure sustainability through economic opportunities, a variety of partners (Boeing, Sandia National Laboratories, and NIST) have become involved with the education, the projects, and the research.
- FAMU MICI: Secor Strategies, LLC, managing day to day operations for project implementation. FAMU has developed working relationships with many NASA centers in support of the technical sessions for MICI.
- SUAGM: Michigan Technological University (MTU) was previously funded to develop a Capstone Senior Design course for the Exploration Systems Mission Directorate. SUAGM is leveraging this experience and utilizing it for the development of their capstone courses. In addition, plans for dissemination include the National Space Grant Consortium, which will also be facilitated by MTU.
- NMSU developed a partnership with Humboldt State University, who is using the NMSU astronomy coursework for 55 students. The series of 13 short films highlighting members of underrepresented groups with productive careers in astronomy-related STEM

fields are also being requested for use at the National Radio Astronomy Observatory (NRAO) website and the visitor center at Arecibo Observatory in Puerto Rico, with Spanish subtitles.

- NCA&TSU has secured additional funds from the state, for an additional \$100K per year, for every year of NASA funding.