Minority University Research and Education Program (MUREP)
Community College Curriculum Improvement (MC3I)
Annual Report
FY2014 (10/1/2013 – 9/30/2014)

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Activity Description

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

In an effort by the NASA Office of Education to create efficiencies, the CURRICULUM Improvement Partnership Award for the Integration of Research (CIPAIR) was consolidated into MUREP as the MUREP Community College Curriculum Improvement (MC3I) activity. The MC3I activity assists minority-serving institutions with strengthening their science, technology, engineering and mathematics (STEM) academic fields and technical programs. Funding is used to increase the quantity and quality of STEM curricula, the number of underrepresented and underserved students who attain STEM degrees, and the number of underrepresented and underserved students who choose careers in NASA-related fields. Examples of funded activities include: engaging students and faculty in research at NASA Centers and facilities; building alliances/partnerships between community colleges and research universities to enhance the availability of research experiences and ease the transition of students from two- to four-year institutions; and providing MSI faculty with professional development and training to teach STEM courses.

Activity Goals

The primary goal of MC3I is to help Minority Serving Institutions (MSIs) strengthen their curriculum in order to attract more students into STEM-based academic programs, retain them, and prepare them for success when they take the next steps in their education or careers. The strategy for achieving improvements in curriculum and student-learning outcomes is built upon four elements:

- Establishment or strengthening of relationships of MSIs faculty with NASA Centers;
- Integration of NASA-related content and research opportunities into the MSIs curriculum;
- Involvement of students in curriculum development and improvement; and
- Commitment of the MSIs administration to long-term sustainability.

It is through these elements that MC3I addresses the NASA Annual Performance Indicators (APIs) for FY2014 and priority STEM education areas identified by the Committee on STEM Education (CoSTEM) of the National Science and Technology Council (2013).

MC3I addresses the following FY14 Annual Performance Indicator (API):

- ED-14-1: Provide significant, direct student awards in higher education to (1) students across all institutional categories and types (as defined by the U.S. Department of Education); (2) racially or

ethnically underrepresented students, (2) females, and (3) persons with disabilities at percentages that meet or exceed the national STEM enrollment percentages for populations, as determined by the most recently publicly available data from the U.S. Department of Education's National Center for Education Statistics for a minimum of two of the three categories.

The CoSTEM priorities that are indirectly supported by MC3I are:

- Enhance STEM Experience of Undergraduate Students: Graduate one million additional students with degrees in STEM fields over the next ten years

- Better Serve Groups Historically Under-represented in STEM Fields: Increase the number of students from groups that have been underrepresented in STEM fields that graduate with STEM degrees in the next 10 years and improve women's participation in areas of STEM where they are significantly underrepresented.

Activity Benefit to FY2014 Performance Goals

MC3I directly addresses Annual Performance Goal 2.4.1. (*Assure that students participating in NASA higher education projects are representative of the diversity of the Nation.*) of the NASA education strategic plan. Additionally, MC3I contributes to the national agenda for STEM with a focus on the community college STEM pipeline. MC3I institutions have continued to promote a number of the "Elements of Successful STEM Education Programs," described in the President's Council of Advisors on Science and Technology, *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics (STEM).*

As a higher education-focused activity within MUREP, MC3I is responsible for reporting data from FY2014 during this reporting call, with finalized **data for FY 2013 that addresses APG 5.1.2.1: ED-14-1:**

- 133 revised or new NASA-related STEM courses during FY2013
- 8,605 total course enrollment
- 22 MC3I students engaged as Summer Interns at six NASA Centers

Activity Fiscal Year Accomplishments

The following FY2014 MC3I accomplishments were noteworthy:

- Navajo Technical University (NTU) offered courses (DFT 111-Mechanical Drafting, DFT 112-Advanced Mechanical Drafting, IT 340-Robotics/offline Programming, IT 325-Computer Simulation, IT 470-Capstone and IT 101-Introduction to Technology) that met with over 53 students over the course of the fall 2013 semester and spring 2014 semester. These offerings included courses created for the Digital Manufacturing curriculum, and also requirements for the Computer Technology and Industrial Engineering programs. The number of students being exposed to the NASA content infused within the curriculum is expanding. The content includes laser scanning projects developed by NTU in partnership with Marshall Space Flight Center, manufacturing technology used by NASA to manufacture rocket components, and rapid prototyping technologies similar to those housed at AMES and Marshall. A lab created with funds from the MC3I cooperative agreement is now a functioning part of the experiential learning that takes place at Navajo Technical University, providing the necessary space, technology, software and supplies for students to work on STEM projects that are an application of their

engineering education. Students work in the lab to create and test theories as well as carry out research.

- Grambling State University (GSU)/Southern University of Shreveport, LA (SUSLA) implemented a "bridge" activity consisting of: 1) Two introductory research seminars/workshops given by GSU faculty to SUSLA students (40 students each) to broaden their understanding of scientific methods and enhance their interest in higher education and motivate them to continue their studies at GSU after graduating from with associate degrees; and 2) a workshop for 12 SUSLA students, conducted at GSU research laboratories, to provide firsthand experience using research laboratory equipment through demonstrating the functionality and capabilities of the research equipment on campus.

- Cañada College/San Francisco State University MC3I students developed and delivered workshops to participants of the 2014 Summer Engineering Institute (SEI) program, funded by the US Department of Education. SEI is an annual two-week residential program held at the San Francisco State University campus for underrepresented high school sophomores and juniors from all over California.

- Fourteen supported students participated in "Winternships" at College of the Desert (COD). Five additional students were supported from other funding sources. Ten "Winternship" students are underrepresented minorities. Eight were offered summer internships, funded by sources other than MC3I. Eleven are transferring to 4-year degree programs. All "Winternship" students remain enrolled in STEM disciplines.

Activity Contributions to FY2014 Annual Performance (API) Measures and CoSTEM Priorities

Successful MC3I-supported activities have contributed to performance measures and CoSTEM priorities as follows:

- FY2014 MC3I partnerships included 7 Minority Serving Institutions (MSIs)
  - Of the 7 MSIs, 4 are HBCUs (57%); 2 are HSIs (29%); and 1 is a TCUs (14%)
  - Representation of 3 community colleges or two-year institutions (43% of total MC3I MSIs)
- Of the students enrolled in new and/or revised courses in **FY13**, 3,271 students reported membership in an underrepresented minority group (38%). Of the underrepresented minority students who reported gender*, 1,847 (49%) are female students
  - 1,610 African American; 1,269 Latino/Hispanic; 344 Native American; 48 Pacific Islander

**students may have chosen not to state ethnicity or gender*

Activity Fiscal Year Improvements

In FY2014 the project management team worked with the remaining awardees to ensure the successful conclusion of their no-cost extension activities in FY15.

During the span of the activity, MC3I has incorporated several strategies for institutional and research building capacity, including but not limited to the following:

- Involving students and faculty in NASA-related STEM research at NASA Centers.

- Building alliances/partnerships between community colleges and research universities to enhance the availability of research experiences to students at community colleges and ease their potential transitions from two- to four-year institutions.
- Providing mentoring through role models of diverse backgrounds to inspire students and help them excel in STEM subjects.
- Providing faculty with profession development and training to teach STEM courses, through summer institutes and programs organized by professional societies and organizations.

Activity Partners and the Role of Partners in Activity Execution

The 17 awardees (including 4 active projects in FY2014) are partners in MC3I. Other partners include six NASA Centers that collaborate with these awardees to develop NASA-related curriculum and provide summer research experiences for students and faculty. Several institutions are also developing partnerships with other entities to expand and sustain MC3I activities:

- As a result of the MC3I award, Rust College created a partnership with Mississippi State Department of Basic Science of Bioinformatics and The University of Southern Mississippi. This partnership was established through a grant funded by MSINBRE for a Bioinformatics Workshop via subcontract with The University of Southern Mississippi. Rust has also partnered with Tuskegee University Computer Science Department and the University of TN Center for Health Sciences Department of Anatomy and Neurobiology.

- Thirty students and faculty from the University of Pennsylvania visited the Navajo Technical University Lab to observe the benefits of the laser technology housed at NTU, and learn about the capabilities of the scanning to 3D modeling and printing. A partnership was created with the University of Pennsylvania and the NTU Building Information Modeling (BIM), Geographic Information Technology (GIT) and Digital Manufacturing programs.

- Dr. Naidu Seetala, PI for the Grambling State University/Southern University at Shreveport, Louisiana MC3I activity, obtained funding from two grants: 1) "Advanced Ceramic Materials Processing and Characterization Using Position Lifetime Spectroscopy, SEM, Micro-hardness, and FT-IR," (Sept. 2013 – Dec. 2014), Air Force – Materials & Manufacturing grant; and 2) LA-SiGMA-"Louisiana Alliance for Simulation Guided Materials Applications." Dr. Barry Hester, Co-I from SUSLA obtained funding from the NSF – "The Louis Stokes Louisiana Alliance for Minority Participation (LS-LAMP).

- Dr. Alec Sim, Co-I of the CSU San Bernardino/College of the Desert MC3I, was awarded a NASA grant to continue his summer activities at NASA-Armstrong over the summer of 2015. Michael Butros, a community college faculty member at Victor Valley College was supported by NASA-MC3I money to spend a summer at NASA- Armstrong (2014). For summer 2015, he is supported by the NSF-CREST grant for this activity. Additionally, Dr. Sim, Michael Butros, and Dr. Carl Farmer (College of the Desert) are partners on the NASA/CASGC MICROCOMPUTER & ROBOTICS INTERNSHIP program.

Dissemination and Scientific Presentations

On May 7, 2014, Rust College/ Mid-South Community College faculty and students gathered for an annual review/presentation of NASA MC3I activities, and a luncheon dialogue with other key personnel from the Rust College/Mid-South Community College Administration.

On February 22, 2014, Rust College student Nekesa Oliver conducted a Power Point Presentation at The University of Memphis Annual Biology/Chemistry Internship results presentation.

Seven students from the Rust College/Mid-South Community College partnership delivered presentations on their summer research at MSCC on September 26, 2014. The presentations were reviewed by Dr. Frank Yeh, PI, and other activity personnel.

Navajo Technical University students and a faculty member attended the American Indian Science and Engineering Society (AISES) National Conference that took place from October 31, 2014 through November 3, 2014 at the Denver Convention Center in Denver, Co. Four students (Dedrick Tolino, Eric Bailey, Vernon Kaye and Kimberly Mahung) gave poster and oral presentations.

The research collaborations from the Grambling State University/SUSLA partnership resulted in the following presentations and publications:

- "Defect Analysis of Heavy Ion-Irradiation of Polyethylene and Composites with Martian Regolith", N. V. Seetala and N. Tull-Walker, International Conference on Application of Accelerators in Research and Industry, San Antonio, Texas, May 25-30, 2014.
- "Synthesis and characterization of polyimide-carbon nanotube composites", N. V. Seetala, C. R. Hendon, N. Tull-Walker, J. Van Behr, B. Hester, M. Lebron-Colon, and M. A. Meador, World Journal of Engineering 11(3) (2014) 193-198.
- "Positron lifetime studies of irradiated ultra-high molecular weight polyethylene and composites made of Martian regolith", N. V. Seetala, N. Tull-Walker, A. Baburaj, J. Zhou, R. Wilkins, and M. Barnett, THERMEC '2013: International Conference on Advanced Materials, Dec. 2-6, 2013, Las Vegas; paper published in the Science Forum 783-786 (2014) 1585.
- "Synthesis of Azide Ligands for PAMAM Dendrimers/Polymers", M. County and B. Hester, American Chemical Society National Meeting, March 16-20, 2014, Dallas, TX.
- "Research Experience - STEM Undergraduate Gear-up", N. V. Seetala, M. Himaya, P. Derosa, M. F. Ware, D. Hubbard, and Y. B. Reddy, Proceedings of INTED2013 Conference, ISBN: 978-84-616-2661-8, Published by International Association of Technology, Education and Development (IATED), Edited by L. Gómez Chova, A. López Martínez, I. Candel Torres, IATED, pp-2792-2801.
- "Synthesis of Azide Ligands for PAMAM Dendrimers/Polymers", M. County and B. Hester, 7th Health Disparities Conference, March 10-12, 2014, New Orleans, LA.
- "Material science programs at GSU and SUSLA/NASA research collaborations" seminar presented by Dr. Naidu V. Seetala, Edward Bouchet Endowed Professor in Physics, Grambling State University, at Southern University-Shreveport, April 22, 2014.
- "Irradiation effects of Ultra high molecular weight polyethylene and composites made of Martian regolith studied by PALS", N. Tull-Walker, N. Seetala, and A. Baburaj, Louisiana Academy of Sciences Annual Meeting, LSU Alexandria, Saturday, March 8, 2014.
- "Super-linear Convergence via Mixed Generalized Quasi-linearization Method and Generalized Monotone Method", N. Tull-Walker, Projects in Physics seminar, GSU, Grambling, April 24, 2014.
- "Synthesis of Azide Ligands for PAMAM Dendrimers/Polymers", M. County and B. Hester, Emerging Research National Conference (ERN), Feb. 19-23, 2014, Washington, D.C.
- "Synthesis and Characterization of Polyimides-CNT Composite Films", J. Van Behr and B. Hester, American Association for the Advancement of Science (AAAS), Feb. 14-16, 2014, Chicago, IL.
- "Synthesis of Azide Ligands for PAMAM Dendrimers/Polymers", M. County and B. Hester, Louis Stokes Midwest Center of Excellence, Oct. 20-22, 2013, Indianapolis, IN.

- "Synthesis and Characterization of Polyimides-CNT Composite Films", J. Van Behr and B. Hester, NanoBio Summit, Oct. 17-19, 2013, Montgomery, AL.
- "Synthesis of Azide Ligands for PAMAM Dendrimers/Polymers", M. County and B. Hester, South Central Chapter of Society of Toxicology, Oct 10-11, 2013, Baton Rouge, LA.

Research conducted by 16 Cañada College engineering students during their 2014 summer internships resulted in 10 published papers and 8 student poster presentations. Students William Berrios, Giovani Rodriguez, and Colin McGill received one of the 2014 SACNAS Student Presentation Awards at the 2014 SACNAS (Society for Advancement of Hispanics/Chicanos & Native Americans in Science) National Conference in Los Angeles for their poster presentation titled "Closed-Loop Feedback Temperature Controlled Encasement to Test Optimal Temperature for Poly Lactic Acid (PLA) and Acrylonitrile Butadiene Styrene (ABS) Polymers for the Punchtec Connect XL 3D Printer." Additionally, two of the papers on the MC3I partnership authored by PI Dr. Amelito Enriquez received best paper awards. The paper titled "Assessing the Impact of Research Experiences on the Success of Underrepresented Community College Engineering Students," received the Best Paper Award from the Minorities in Engineering Division of the 2015 American Society of Engineering Education Conference in Seattle, WA. The paper titled "Expanding the Community College Engineering Educational Pipeline through Collaborative Partnerships," received the first ever Best Diversity Paper Award at the 2015 ASEE Pacific Southwest Section Conference in San Diego, CA.

During FY2014, the Cañada College partnership published a total of 10 papers, with two of the papers receiving best paper awards. Additionally, in March 2014 Cañada College Engineering Professor and MC3I PI, Dr. Amelito Enriquez, presented a workshop titled "Creating Opportunities for Minority Students Through Collaborative Partnerships," at the Alliance of Hispanic-Serving Institution Educators Conference, in Laverne, CA. A complete listing of published papers for FY2014 is as follows:

- Enriquez, A. G., et al. (2015, June). *Assessing the Impact of Research Experiences on the Success of Underrepresented Community College Engineering Students.* Paper presented at the American Society of Engineering Education Conference, Seattle, WA. **Best Paper: ASEE Minorities Division.**
- Enriquez, A. G, et al. (2015, April). *Expanding the Community College Engineering Educational Pipeline through Collaborative Partnerships.* Paper presented at the American Society of Engineering Education Conference Pacific Southwest Section Conference, San Diego, CA. **Best Diversity Paper.**
- Melgar, R., et al. (2015, April). *Teaching Brain-Inspired Visual Signal Processing via Undergraduate Research Experience*. Paper presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Martinez, T., et al. (2015, April). *Engaging Community College Students in Earthquake Engineering Research on Real-Time Hybrid Simulation*. Paper presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Ettedgui, N., et al. (2015, April). *Engaging Community College Students in Engineering Research through Design and Implementation of a Cyber-Physical System for Myoelectric-Controlled Robot Car*. Paper presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Kinsler, M., et al. (2015, April). *3D Printing as an Enabling Platform for Cross-Disciplinary Undergraduate Engineering Education and Research*. Paper presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Rentsch, N., and Enriquez, A. (2014, June). *Improving Engineering Curriculum and Enhancing Underrepresented Community College Student Success through a Summer*

Research Internship Program. Paper presented at the American Society of Engineering Education Conference Indianapolis, IN.

- Robles, A., Alvarez, D., Flores, J., Htun, C., Chen, C., Enright, J., Enriquez, A., and Pong, W. (2014, April). *Preparing Community College Students for Civil Engineering Profession through Design and Evaluation of a Three-Story Steel Plate Shear Wall*. Paper presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.
- Buell, M., Dababo, N., Figueroa, R., Moala, P., Enriquez, A., Bai, K., Pong, W., and Jiang, H. (2014, April). *Learning by Doing, a Method to Engage Underrepresented Minority Students Learning Electrical Circuits*. Paper presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.
- Valdovinos, J., Chen., C., Davis, A., Enriquez, A., and Pong, W. (2014, April). *Reliability Analysis for Real-Time Hybrid Simulation with Fluid Viscous Dampers*. Paper presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.

A total of 8 student posters were presented by Cañada College interns in the past year:

- Melgar, R., et al. (2015, April). *Modeling and Implementation of Brain-Inspired Neural Network for Edge Detection and Object Recognition*. Poster session presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Martinez, T., et al. (2015, April). *Evaluating Effects of Delays on Real-Time Hybrid Simulation of Seismic Response of Large Civil Structures*. Poster session presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Ettedgui, N., et al. (2015, April). *Design and Implementation of an EMG Control System*. Poster session presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- Berrios, W., et al. (2015, April). *Closed-loop Feedback Temperature Controlled Encasement to Test the Optimal Temperature for Poly Lactic Acid (PLA) and Acrylonitrile Butadiene Styrene (ABS) Polymers for the PunchTec Connect XL 3D Printer*. Poster session presented at the American Society of Engineering Education Pacific Southwest Section Conference, San Diego, CA.
- García, J., Lopez-Casildo, F., Lewis, C., Vargas, V., Celik, O., and Rentsch, N. (2014, April). *Dynamic Plant Development for Control Systems and Mechatronics Experiments*. Poster session presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.
- Prado-Guerrero, H., Ettedgui, N., Koushkebaghi, A., Melgar, R., Mahmoodi, H., and Amir, M. (2014, April). *Modeling and Implementation of Brain-Inspired Neural Network for Edge Detection and Object Recognition*. Poster session presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.
- Robles, A., Alvarez, D., Flores, J., Htun, C., Enright, J., and Chen, C. (2014, April). *Utilizing Steel Plate Shear Walls for Seismic Hazard Mitigation*. Poster session presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.
- Buell, M., Dababo, N., Figueroa, R., Moala, P., Bai, K., and Jiang, H. (2014, April). *Optimizing a Wirelessly Powered AC-DC Booster for Biomedical Implants*. Poster session presented at the American Society for Engineering Education Zone IV Conference, Long Beach, CA.

The CSU San Bernardino/College of the Desert partnership reported the following presentations and publications in FY2014:

- Carl Farmer presented at the American Geophysical Union (AGU) Fall Meeting December, 2014 describing the "Winternship" model and summarizing the success of the program to date.
- Tim Usher presented at the Air Force Research Labs Organic Materials Chemistry Program Review, October 27-31, 2014.
- MC3I supported students (Nicole Lopez, Joseph Martinez, and Luis Jauregui) were selected to present research at Emerging Researchers National (ERN) Conference in Washington DC. They were also awarded travel grants (February 2015).
- Five students gave exit posters and presentations at NASA-Armstrong at the conclusion of their summer internships.
- Four students presented their research results at the Southern California Conference on Undergraduate Research (SCCUR) (November 2014).