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## **AC 2012-4036: EXPANDING THE ENGINEERING PATHWAY FOR UNDERREPRESENTED MINORITIES**

### **Ms. Aileen M. Walter, National Action Council for Minorities in Engineering, NACME, Inc.**

Aileen Walter began her second stint at NACME as Vice President, Scholarships and University Relations. In this capacity, she is responsible for the management and direction of all NACME scholarship programs and scholarship management services. In 2003, she implemented the NACME Scholars' Program, an initiative that includes a partnership with more than 40 colleges and universities. She also administers the Alfred P. Sloan Minority Ph.D. and Indigenous Graduate Partnerships. Both programs are focused on increasing the number of underrepresented American minorities who earn Ph.D. degrees in mathematics, the natural sciences, and engineering. Walter has more than 20 years of experience in scholarship management and in developing successful college and university partnerships to increase the representation of underrepresented minorities. She currently serves as a member of the Association of Public and Land-Grant Universities Minority Male STEM Initiative Task Force, the Advisory Council for the University of Colorado's Broadening Opportunity through Leadership and Diversity Initiative, and Cornell University's Diversity Programs in Engineering Advisory Council and has served on the boards of the National Society of Black Engineers and the Society of Hispanic Professional Engineers. Walter holds a B.A. degree in English literature from Montclair State College and a M.A. degree in higher education administration from New York University. The mission of NACME is to ensure American resilience in a "flat" world by leading and supporting the national effort to expand U.S. capability by increasing the number of successful African American, American Indian, and Latino women and men in science, technology, engineering, and mathematics (STEM) education and careers. For the past 37 years, NACME has established a legacy of leadership and service in its dual role of changing lives through its involvement in K-12 and higher education, and its ability to change America through its policy leadership advocacy to develop an engineering workforce that looks like America.

### **Ms. Sandra Johnson Austin, National Action Council for Minorities in Engineering, NACME, Inc.**

Sandra Johnson Austin joined NACME on Sept. 1, 2010 as Senior Vice President for Operations. Johnson Austin has a combination of secondary, post secondary, non-profit, and corporate experience that gives her a unique perspective of NACME's mission. She received a bachelor's of science (B.S.) degree in civil engineering from the Pennsylvania State University and a master's of business administration (M.B.A.) degree from the University of Notre Dame. Prior to joining the NACME team, she served as the first President and CEO for St. Michael's High School in Santa Fe, N.M., and from 2005-2008, she served as the Executive Vice President for the Community Partnership for Lifelong Learning (CPLL) in Benton Harbor, Mich. From 2000-2005, she was Executive Director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. [GEM]. From 1994-2000, she held the position of Director of the Minority Engineering Program at the Pennsylvania State University. Johnson Austin also worked for seven years with Bechtel Power Corporation in progressively more complex assignments as a Field Cost Engineer, Civil Estimator, Assistant Cost Engineer, and Cost Engineer. In addition to her professional titles, she has also been a long-time advocate for the education of underrepresented minorities in STEM and has published and presented several papers on the topic at national conferences to government agencies and Fortune 500 companies.

## **Expanding the Engineering Pathway for Underrepresented Minorities**

### **Abstract**

With rapid progress in science and technology in developing countries, our nation must act quickly to maintain a leadership position in STEM and innovation. Yet the challenge of the increased diversity of U.S. college students has yet to be adequately addressed, especially in engineering fields. XXX's vision is to create "An Engineering Workforce That Looks Like America," via increased recruitment and degree completion rates of underrepresented minority (URM) students.

Since 1974, the National Action Council for Minorities in Engineering, Inc. (XXX) has developed partnerships at 160 colleges and universities providing \$24 million to 22,000 underrepresented minority engineering students. XXX has had a longstanding history for supporting the engineering pathway for African American, Latino and American Indian men and women.

While the primary XXX delivery model has been through scholarships, supported by a preeminent group of Fortune 500 companies, XXX has learned that achieving success in increasing underrepresenting minority participation in engineering study requires a multifaceted strategy to address the continuum from middle school to workforce entry. The multifaceted XXX strategy integrates our programs designed to increase the number of underrepresented minorities who earn their baccalaureate degrees in engineering. These initiatives include, Pre-Engineering Programs, Scholarships and University Relations; Research; and Policy.

The session will address XXX's STEM Integration Model with a focus on partnerships, best-practices and data driven strategies with the goal of expanding the engineering pathway. More specifically, we will highlight XXX's college and university partnerships to increase the retention-graduation rates of URM students in engineering, as well as the cultivation of middle and high school, community college students' success in STEM.

Topics that will be addressed include:

- Developing innovative partnerships to increase the capacity and capability of academic institutions to recruit, admit, retain, educate and graduate underrepresented minority students in engineering
- Establishing regional pilot projects across the United States
- Measuring the impact of XXX's STEM Integration Model

## Background

This is a critical time for our nation. While the United States has led the world in global innovation, economic competitiveness and national security through a strong Science, Technology, Engineering, and Mathematics (STEM) platform, today, this position is at risk.

In order for the United States to maintain the global leadership and competitiveness in science and technology that are critical to achieving its national goals, we must invest in research, and grow a strong and talented science and technology workforce that looks like America. Developing and retaining STEM talent is critical to fuel innovation, yet the demand for talent far exceeds the supply. The situation is further exacerbated among underrepresented minorities (URM – African American, Latinos and Native American Indians). Consider this:

- Between 2010 and 2050, the relative percentage of the U.S. population that is white and not Latino is expected to decline from 65 percent in 2010 to 46 percent in 2050. By then, Latinos will account for 30 percent of the U.S. population.<sup>1</sup>
- Latinos make up more than 16 percent of the U.S. population, but account for only six percent of U.S. engineers.<sup>1</sup>
- African Americans make up 12 percent of the U.S. population, but account for only five percent of the U.S. engineers.<sup>1</sup>
- American Indians make up 0.77 percent of the U.S. population, but account for only 0.25 percent of the U.S. engineers.<sup>2</sup>
- Only 13 percent of African American high school students, 27 percent of Hispanic/Latino high school students and 26 percent of American Indian high school students are prepared for mathematics college coursework according to a 2011 ACT study
- The Bureau of Labor Statistics projects a need for 178,000 more engineers in the next decade with the fastest growth in biomedical, civil, environmental, industrial, and petroleum engineering
- While there are about 70,600 engineering bachelor degrees awarded annually in the US, only 4.3 percent are awarded to African Americans (12 percent in the U.S. population) and 7.8 percent to Hispanics (16 percent in the U.S. population)<sup>1</sup>

Given the confluence of the rapid demographic changes that are occurring in America, the impending retirements of a significant portion of our exiting STEM workforce, and the necessity to blunt the slide in science and technology leadership and competitiveness on the global stage, an effective and workable solution is required to avert a Category 5 Storm.

Since 1974, the XXX. (XXX) has developed partnerships at 160 colleges and universities providing \$124 million to 22,000 underrepresented minority engineering students. XXX has had a longstanding history for supporting the engineering pathway for African American, Latino and American Indian men and women.

XXX is uniquely positioned to stand at the forefront of this critical imperative to help shape the futures of underrepresented minorities who need to be the new leaders in American innovation in the coming decades.

### **Statement of Need**

The importance for Science and Engineering (S&E) to the United States has been documented in a series of reports for more than half a century. Nevertheless, critical issues for the nation's S&E infrastructure remain unsettled. Among them, America faces a demographic challenge with regards to its S&E workforce: Minorities are seriously underrepresented in science and engineering, yet they are also the most rapidly growing segment of the population.

Underrepresented minority groups comprised 28.5 percent of our national population in 2006, yet in the same period, represented just 9.1 percent of college-educated Americans in science and engineering occupations. Minorities in science and engineering would need to triple their numbers to match their share of the overall U.S. population. Underrepresentation of this magnitude in the STEM workforce is a result of the underproduction of minorities in STEM disciplines at the pre-college level, with a progressive loss of representation as we proceed up the post-secondary academic ladder.<sup>3</sup>

In 2009 the U.S. graduated some 70,600 engineers, only 13 percent (9,020) of which were underrepresented minorities. While the case has been made for increasing the domestic talent pool by increasing opportunities for native-born students to prepare for study in STEM disciplines, there are still many Americans who are not likely to have these opportunities available to them.

### **Solution**

Over the past two years, XXX hosted a Continuum Partner Meeting with the goal of connecting key constituents across the middle school to workforce entry continuum in support of maximizing the transformative power among our partners to create a technologically educated and productive US workforce. In year one, the goal was to introduce, lay the early ground work, and more formally connect XXX pre college initiatives with university partner programs and the XXX corporate community.

In year two, more than 150 participants joined in a three day meeting held in Houston, Texas. The October 2010 meeting that sought to validate and refine the model, establish further structure and to gather multiple perspectives on the best path forward. Present at the meeting were middle and high school teachers, principals and guidance counselors; community college and university administrators; corporate executives; as well as STEM representatives from various government agencies, e.g., Department of Energy.

Further, the meeting sought to define the:

- Current relationships between XXX's pre-college partners and partner universities and to assess the efficacy of such relationships both at the K-12 and post-secondary levels;
- Initiatives that have led to higher graduation and retention rates at XXX's partner high schools and university levels; and
- Outreach available to high schools, existing pre-college programs, and finally, the impact of such programs on student success.

Recommendations arising from the meeting included:

- Inviting participation from both pre-college and university partners to develop and implement an integrated model;
- Piloting the model among the pre-engineering AOE's and university partners located in the New York region as well as the State of Texas; and
- Replicating the pilot model in selected regions throughout the country

On the pages that follow is a new approach of strategic thinking that integrates XXX's portfolio of programs and services from middle school to workforce entry, known as the XXX STEM Integration Model.

### **XXX Stem Integration Model**

XXX partners with a national network of 50 leading colleges and universities to recruit, enroll, educate, retain and graduate increasing numbers of URM students. XXX is responsible for more than one thousand scholarships awarded annually to URM students. Through the XXX Scholars Program, block grants are provided to colleges and universities that in turn, award funding as part of financial packages to qualified students enrolled in engineering programs. In 2010, XXX Partner Institutions graduated 33 percent of underrepresented minority (URM) students earning bachelor's degrees in engineering through its public-private partnerships.<sup>2</sup>

In collaboration with educational partners, the organization has launched a national network of urban-centered, open enrollment, academies of engineering that provide all students with a strong science and math education to assure college readiness for engineering study.

The NACME STEM Urban Initiative provides resources to middle school, high school and community college students and educators that include student scholarships, grants to educators, engineering awareness materials and corporate participation on schools' local advisory boards.

To date, the major Pre-Engineering Initiatives, Academies of Engineering (AOEs) and XXX STEM Urban Initiative (NSUI), have operated largely in parallel with the University Partner programs. As AOE students are now reaching college-age and our Urban Initiative is implemented as a major strategic thrust, XXX will broker connections between our pre-college and post-secondary partners to develop effective pathways for transition and success in

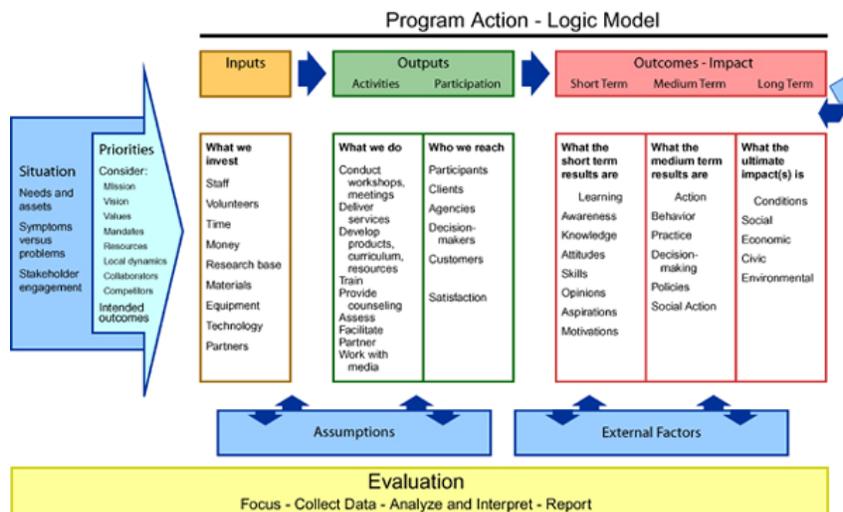
engineering school. In the long-term, XXX Scholars will join the cadre of engineers in the US workforce, adding their unique insights.

To further increase the production of degrees earned by underrepresented minorities, XXX seeks to facilitate a comprehensive pathway to engineering careers for URM students beginning in middle school, through the XXX STEM Integration Model. The goal of the XXX STEM Integration Model is to facilitate a comprehensive pathway of URM students to engineering careers beginning in middle school. Our objectives include the following:

- To develop regional partnerships of institutions along the XXX continuum
- To ensure that partners are invested in the XXX Brand
- To evaluate each program based on expectations outlined in the Memorandum Of Understanding (MOU)
- To increase operational efficiency of linkage programs
- To ensure evaluation is integrated across all XXX linkage programs
- To target funding opportunities for the integration model

A program action-logic model and evaluation process was used to develop the XXX STEM Integration Model. A logic model defines a situation and priorities, as well as the inputs, outputs (i.e., activities, participants, etc.) outcomes and anticipated impacts (short, medium, long-range) of a program, as well as the assumptions and external factors associated with the plan and context. The logic model shows the chain of connections of how a program is expected to work to achieve the desired results. The figure below depicts the iterative steps taken to improve XXX’s initiatives, programs, and services for fiscal 2012 and beyond.

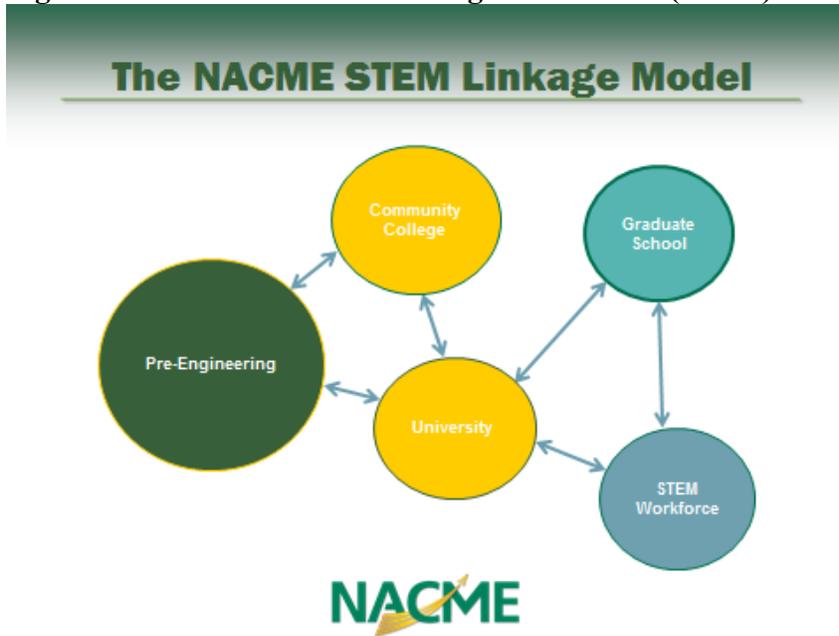
**Figure 2.0 – Program Action- Logic Model**



Fiscal year 2011 presented opportunities for XXX to focus more heavily on its research efforts. The organization has a clear understanding that research drives evaluation and policy. However, program evaluation has become the priority in implementing programs and services for fiscal year 2012.

XXX will integrate existing program elements into a unified continuum that leverages existing partnerships for students to move along the XXX continuum from:

**Figure 3.0 – The XXX STEM Integration Model (NSIM)**



- a) Academies of Engineering high school juniors and seniors to XXX Scholars (Block Grant) Program Partner Institutions
- b) XXX STEM Urban Initiative (NSUI) students to XXX Scholars (Block Grant) Program
- c) XXX Scholars Program Partner Institutions to the Alfred P. Sloan Foundation Minority Ph.D. and Sloan Indigenous Graduate Partnership Program faculty
- d) XXX Scholars to board companies for the purpose of gaining hands-on engineering experience in a summer internship/co-op assignment or to seek a full-time position

### **Evaluation**

XXX's investment in educational strategies serving URM students from middle school through workforce entry is vital to expanding the pipeline of future engineers and, ultimately, contributing to America's global competitiveness. As an authoritative resource on research and evaluation related to diversity in STEM education and careers, XXX is uniquely positioned to conduct a longitudinal study to measure URM students' academic success (including high school and post- secondary completion rates).

The evaluation model will focus not only on measuring academic success, but also on XXX's effectiveness in leveraging partnerships and the use of XXX resources in guiding students' academic and career decisions. XXX will develop and implement MOUs with partner institutions, pre-engineering partners, and XXX sponsoring companies, which define the roles, responsibilities, timelines, and evaluation process. A logic model for the linkage strategy has been developed outlining the goals, objectives, measurable outcomes, and data collection timelines.

### **Bibliographic Information**

1. National Action Council For Minorities in Engineering, Inc., 2011 XXX Data Book
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3. The National Academies, Expanding Underrepresented Minority Participation: America's Science and Technology at the Crossroads. Available at <http://www.nap.edu>
4. National Action Council For Minorities In Engineering, Inc., Program Evaluation and Policy Department analysis of data provided by the American Society for Engineering Education.