

## **AC 2010-927: ADVANCE PEER MENTORING SUMMITS FOR UNDERREPRESENTED MINORITY WOMEN ENGINEERING FACULTY**

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(*“Navigating Your Journey on the Academic Sea”*;  
NSF ADVANCE Conference, Over 60 URM Women Engineering Faculty @ Caltech Photo credit: B. Paz)

### **Abstract**

As they progress in their engineering faculty careers, Underrepresented Minority Women (URM) women are very familiar with unique issues at the intersection of race and gender (DeCuir-Gunby, Long-Mitchell, & Grant, 2009; Ranson, 2005; Ronen & Ronen, 2008). This familiarity results from their own personal experiences in the Academy and provides a broad set of responses ranging from leaving the professoriate to a single-minded pursuit of success no matter what obstacles are presented (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007; National Research Council, 2006). Efforts have focused on preparing women with innovative approaches to confront and overcome any challenges through a combination of peer, cross cultural and technical mentoring. Supported by a National Science Foundation (NSF) ADVANCE Leadership Grant, the authors convened three Peer Mentoring/ Professional Development Summits articulated *by Women of Color for Women of Color* for over 90 URM women faculty to eliminate the potential “show-stopping” aspects of the journey to tenure (and beyond). This paper reports the outcomes of this series of summits, the impact on the demographics of engineering faculties and the critical next steps in the process.

### **Overview**

Underrepresented Minority (URM) women faculty have emerged as successful leaders in the engineering academia in a growing number of universities across the United States. Increased exposure of this group raises the conversation in academia to a new level and creates partnerships based on scholarship with diversity as an added benefit. There are, however, still unique challenges and opportunities. The representation of URM women faculty at the Top 50 institutions (based on research expenditures) is not reflective of demographics due to a combination of selection/self selection processes and hidden biases in the academia (Nelson, 2007). As they progress in their faculty careers, Underrepresented Minority Women (URM) women are very familiar with unique issues at the intersection of race and gender (DeCuir-

Gunby, Long-Mitchell, & Grant, 2009). The goal of the NSF ADVANCE Program is to develop systemic approaches to increase the representation and advancement of women in academic science, technology, engineering and mathematics (STEM) careers. The outcomes should contribute to the development of a more diverse science and engineering workforce. Our NSF ADVANCE Leadership Award was a three year initiative focused on connecting a group of over 90 URM women engineering faculty; it was collaboration between engineering, educational psychology and adult education. A series of three professional development peer mentoring summits were convened at North Carolina State University (NCSU) and the California Institute of Technology. The summits took as a premise the fact that the utilization of peer faculty groups to coach, mentor, encourage and advise each other can have a positive role in the success of individual faculty.

In the first year, 70 women attended a 2-day summit convened at North Carolina State University (NCSU) for all engineering disciplines. Evolving from the identified needs of the senior women faculty, the second summit took place at NCSU and was a mini-summit specifically structured for Senior Underrepresented Minority women engineering faculty; 25 Full Professors and faculty 2 years away from Full Professor, attended. The senior women focused on identifying best practices in cross-cultural mentoring, leading in the academy, professional development activities (e.g., NSF program director, AAAS Fellows) and developing a collective voice in the academy for issues that go beyond diversity and mentoring, and laid the groundwork for the final summit.

The final summit for 60 women of all ranks, was co-sponsored by California Institute of Technology (Caltech); the culmination of the summit series included a strategic planning meeting to plan to move the connecting activities out to the disciplines through professional societies, and more broadly, NSF, NIH and other governmental funding agencies. This paper will provide insights into the unique issues faced by URM women in the engineering academy and the Peer Mentoring approach to provide positive reinforcement and a network of personal, professional and academic support.

## **Introduction**

Women of color are cognizant of both their racial and gender identities (DeCuir-Gunby, Long-Mitchell, & Grant, 2009; Ranson, 2005; Ronen & Ronen, 2008). There are experiences that are unique to being people of color, likewise there are experiences unique to being women. However, there are many experiences that combine race and gender. This is particularly true in higher education, because both are underrepresented in higher education; both race and gender are salient to their identity. It is not uncommon to be the only African American or Latina<sup>1</sup> and/or the only woman in an academic program and/or department. Since women of color are often the “only ones”, they are in the precarious positions of negotiating both race and gender. This is particularly important in science, technology and engineering (STEM) disciplines.

Previous research interviewing URM women faculty has found several obstacles perceived to impede career progress. In a study published by Turner (2002) titled, “*Women of Color in Academe: Living with Multiple Marginality*” Turner provides an account of her findings by interviewing URM faculty and their impressions of the consequences for URM women being

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<sup>1</sup> African American and Black are used interchangeably as well as Latina(o) and Hispanic.

underrepresented in academia. In that study, various themes emerged as constraining the progress of women in academia. Some of these themes included “feeling isolated and under-respected; salience of race over gender; being underemployed and overused by departments and/or institutions; being torn between family, community, and career; and being challenged by students.” Other subjects such as the challenges posted by the academic “*old boy networks*” were mentioned in these interviews but only *indirectly*. Upon addressing these themes the study provides *positive* suggestions on how to empower women of color to successfully navigate through these themes. The positive suggestions depicted in the study by Turner (2002) include: “Validation of Service and Training, Promotion of Networking and Mentoring, Provision of Professional Development Sensitive to Campus Political Dynamics, Breaking the Conspiracy of Silence, Promotion of a Welcoming Environment, Accommodation of Conflicts of Commitments, and Internal Rewards and Satisfactions.”

### **What are the Demographics for URM Women Engineering Faculty?**

Increased visibility of and exposure to the growing number of URM women who have emerged as successful engineering faculty at their respective universities has raised the conversation in the academia to a new level, creating partnerships based on scholarship, with diversity as an added benefit. While well funded programs exist for women at the national level, there is an unprecedented need for nationally supported initiatives that target engineering faculty of color. More importantly it is a necessity to address both the retention and promotion of these faculty once they achieve the status of engineering faculty member. The program presented in this paper chooses to address this matter through a grassroots effort to *redefine leadership in the academy* by broadening our ideas in terms of relevant scholarly engagements. In addition, the effort will intend to move women towards *excellence* in the academy by expanding their *national presence* through a wide range of professional activities.

Prior to a detailed presentation of the Peer Mentoring Summits, we will present the results of one study that is often cited when discussing the actual numbers of diverse faculty in the engineering academy. Nelson presented data highlighting the absence of women and minority faculty at Top 50 departments (based on NSF research expenditures).

*“In some disciplines, there is no representation of URM (Black, Hispanic, or Native American) women on the faculty at all. In the “top 50” computer science departments, there are no women in tenured or tenure-track positions. With the exception of one Black “full” professor in astronomy, there are **no** female Black or Native American “full” professors in the physical science or engineering disciplines surveyed. Similarly, in physics there are no Black female professors, and in eight of the nine physical science and engineering disciplines surveyed, Native American female professors are nonexistent.” (Nelson, 2005)*

There are few engineering faculty of color at the rank of full professor; Trower and Chait and Leggon indicate that:

*“The data show URM women are less likely than either White women or men of any racial group to be “full” professors and to be awarded tenure. Other studies have also concluded that URM minority females are less likely to get tenure than White women or men of any racial group (Trower and Chait, 2002; Leggon,2001).*

A 2004 report by the National Science Board entitled, “Broadening Participation in Science and Engineering Faculty” concluded that: “*Faculty diversity at post-secondary institutions can be*

achieved with thoughtfully conceived and executed programs for recruiting and retaining science and engineering faculty from underrepresented minority groups." (National Science Board, 2004).

The following table summarizes the updated data found in the aforementioned Nelson reports in 2005 and 2007:

**Table 1: Female URM Faculty at "Top 50"\* Science and Engineering Departments (FY2002/ FY 2007)).**

	<b>Native American females</b>	<b>Hispanic females</b>	<b>Black females</b>
Chemistry	1/ 3 <sup>2</sup>	5 <sup>1</sup> / 9 <sup>3</sup>	1/ 4
Math ('07 includes statistics)	0/ 0	7 <sup>3</sup> / 9 <sup>6</sup>	2/ 4 <sup>3</sup>
Computer Science	0/ 0	0/ 3	0/ 3 <sup>1</sup>
Physics	0/ 1	8 <sup>3</sup> / 5 <sup>1</sup>	0/ 1
<b>Chemical Engineering</b>	<b>0/ 0</b>	<b>3/ 6<sup>1</sup></b>	<b>2/ 4<sup>2</sup></b>
<b>Electrical Engineering</b>	<b>0/ 0</b>	<b>3/ 3<sup>2</sup></b>	<b>7/ 8<sup>1</sup></b>
<b>Mechanical Engineering</b>	<b>0/ 1</b>	<b>2<sup>1</sup>/ 7<sup>1</sup></b>	<b>3/ 5</b>
<b>Civil Engineering</b>	<b>0/ 0</b>	<b>3<sup>1</sup>/ 8<sup>2</sup></b>	<b>2/ 5</b>
<b>Total</b>	<b>1/ 5</b>	<b>33/ 50</b>	<b>19 / 34</b>

\*Nelson's "Top 50" 14 science and engineering disciplines based on research expenditure according to NSF (hereafter referred to as Top 50) is included as a reference point to tenured and tenure track women in science and engineering disciplines only and is not intended to compare to the representation of women in the broader population or in other fields. The few "full" professors (in Table 1) in each discipline are designated by superscript after the corresponding number.

The data in Table 1 shows that the total number of Native American faculty in the Top 50 departments has improved but is still woefully below the number in the general population. Clearly there is a desperate need for effective strategies for recruitment, retention and promotion of Women of Color faculty in the engineering academy. However, there is some good news! According to the above Table 1, the Nelson report was a starting point to benchmark the demographics of URM women in the engineering academy but it underestimated the total number of URM women in the engineering academy. There has actually been some improvement in the number of URM women at Top 50 departments in the past few years. There are also more full professors at these same institutions. A pivotal question of interest to the investigators was raised, "is this Top 50 ranking the best way to measure the progress made by the URM women engineering faculty within the academy?" When a cross-check of the summit participants and the schools listed in the Nelson study was performed, an important fact emerged. Of the over 90 women that participated in the summits, less than 20 were captured in Table 1. This meant that there was a significant group of URM women faculty that was not even a part of the Nelson study that was often used to define the extent of the problem in terms of raw numbers of faculty, making the situation appear even bleaker. For the summits reported in this paper, all of the Chemical Engineering African American females represented in Table 1 participated in the series. The full professor in Computer Science and a faculty member in Mechanical Engineering from the Top 50 departments were also actively engaged in the summits. Another key point was that not all the disciplines of the women who attended the summits were represented in the Nelson study. Prior to this summit series, the authors discovered



through their own networking, that there were actually several URM women engineering faculty that were not captured in the Nelson data: they were part of an emerging network that did not use the Top 50 status as a requirement for networking, collaboration or mentoring. As time went on, we found out just how vast this group of women was in the engineering academy.

While the investigators will not take the total credit for the increase in the number and upwardly mobile success of women faculty at the Top 50, (i.e., the increase in the number of women in Table 1 between 2002 and 2007), the numbers give reason to pause and look at the number of those women that are engaged in this ADVANCE project's peer mentoring network..

### **Review of Related Mentoring Literature and Outlets – Who is Mentoring Whom?**

There is no one operational definition of the term mentoring. It means different things to different scholars and is highly contextual. Educator Rosemary Caffarella suggests that mentoring is defined as an "intense caring relationship in which persons with more experience work with less experienced persons to promote both professional and personal development." We conceptualize mentoring as occurring in several forms: mentor/protégé, peer-to-peer, and cross boundary (e.g., cultural, racial, and gender). We focus primarily on peer and cross boundary mentoring. While the majority of the women of color in engineering academia are under the age of 50, in the past 10 years, there are a number of women that have assumed leadership positions in engineering colleges and at the university level. The existence of these women leaders presents an exciting opportunity an expanded network of mentors and the development of a community of support.

*Peer mentoring.* There are countless Women of Color that have set up ad hoc mechanisms for peer mentoring (especially since there are few women at advance levels of faculty ranks). While these "hit-or-miss" mentoring and networking opportunities have been the norm for a long time, a significant improvement in the number of women pursuing careers will require a paradigm shift in how these women interact with each other. For example, at the 1999 Black Women in the Academy Conference sponsored by *The African American Women's Institute* at Howard University, Dr. Patricia Mead (engineering faculty member at Norfolk State University, former Sr. Program Officer, Committee on Engineering Education at the National Academy of Engineering) organized a session for Black women engineering faculty. This meeting of twenty-two African American women engineering faculty was held to discuss the challenges and barriers that affect the tenure and promotion process. The discussion led to the identification of six significant factors affecting successful attainment of tenure for Black women faculty in particular. The most important factor identified by the senior faculty within the group was effective mentoring. Other factors included support of the home department, community support, and existing laboratory infrastructure. While there were no real surprises from this survey, the lack of resources to follow-up with the group to effect change caused this initiative to go into hibernation. (It should be noted that Dr. Mead was a member of the Leadership Task Force for the Summit Series)

The need for mentoring is also expressed among Hispanic women. In an article in *Hispanic Heritage*, Leticia Soto, Region 6 vice-president of the Society of Hispanic Professional Engineers (SHPE) states:

We have three strikes against us: being women in a male-dominated field, being Hispanic in a Caucasian world, and being Hispanic females trying to break cultural stereotypes that

our own families and friends try to keep us confined to. It is hard when people do not 'recall' you for rewards or new projects, simply because they cannot pronounce your name; it keeps us from getting the recognition we deserve. (Gonzalez & Musielak, 2002)

The article goes on to report:

Hispanic women also are underrepresented in higher education. Of the 39,400 women employed as S&E faculty and researchers at universities in 1997, only 1,300 were Hispanic – accounting for just 3.3 percent of all female professors and less than 1 percent of the S&E faculty in the nation. (Gonzalez & Musielak, 2002)

Dr. Evelyn Hammonds, a pioneer in issues related to minority women on science and engineering and a professor at Harvard University is quoted as saying that she “was surprised that even in 2002, these women (faculty) had so few opportunities in their professional careers to talk and network with other minority women scientists and engineers” (Nelson & Rogers, 2005).

*Cross boundary mentoring.* Anecdotal information suggests that most underrepresented minority women in this group were not mentored by a person that “looks like” them (i.e., of the same gender and race). An article by Stanley and Lincoln (2005) found that junior and senior faculty and administrators alike were often not sure how to foster effective mentoring relationships. The authors stated that this was particularly true when faculty of color were recruited to predominantly white colleges and universities (Stanley and Lincoln, 2005). These same people were perplexed as to how to proceed due to the lack of experiences with other faculty of color that they can learn from. They asserted that mentoring seemed to be more beneficial in some ways when the mentor and protégé were the same race, gender, or ethnicity, had professional interests in common or were in the same field of study.

It is also important to recognize the strong components of cross-cultural, cross-racial and cross-gender mentoring that have played significant roles in the mentoring of the women that were impacted by this program. In this regard, we propose to glean from the tenured women faculty the critical components of their mentoring experiences that contributed to their success. Furthermore, this project will continue to extract information for the ongoing development of a set of best practices for the mentoring of women of color for success in the academy from two sources: (i) assessment of the women attendees at the mini-summit about their own faculty experiences and (ii) a survey about their mentors from different gender, cultural and/or racial backgrounds. This mentoring information will become one component of a roadmap for the recruitment, retention and promotion of women of color in the academy.

### **Summit Program Overview**

The Peer Mentoring Summit Series was conceptualized based on interactions of women faculty at American Institute of Chemical Engineers (AIChE) Conferences, where an already existent cohort of URM women chemical engineering faculty convened to discuss their own unique challenges of recruitment, retention, promotion, and career opportunities, and to mentor one another. The URM women chemical engineering faculty network from nationally represented universities had naturally formed over time during professional meetings and conferences; the idea to develop a similar model for women faculty in other engineering disciplines emerged from the recognition that peer mentoring had become a dynamic source of support in the careers of the women in the academy.

During the development of the peer mentoring summit series concept, the authors conducted an initial pilot URM Women Engineering Faculty Summit convening a group of Chemical Engineering Faculty in 2005 in eastern North Carolina for the “ChemE Women of Color Faculty Summit at NCSU” in Raleigh, and Wilmington NC.

**Faculty in attendance included the following faculty:**

Faculty participant	Status during summit (2007)	Current status (2010)
Dr. Norma Alcantar	Assistant Professor (U. Of South Florida)	Associate Professor w/ tenure
Dr. Kristala Jones Prather	Assistant Professor (MIT)	Assistant Professor (2nd term)
Dr. Tonya Peeples	Associate Professor ( U. of Iowa)	Full Professor
Dr. Paula Hammond	Associate Professor ( MIT)	Full Professor
Dr. Christine Grant	Professor (NCSU)	Associate Dean
Dr. Tamara Floyd	Assistant Professor (Tuskegee)	Assistant Professor – 2nd term

(It should be noted that all of the women have either been promoted or are in the second term of their reappointment at their home institution. )

The goal was to set up individual discipline specific networks of women acquainted in their disciplines within the engineering academy modeled after the Chemical Engineering group. Chemical engineering is a rather close group professionally; as evidenced by the fact that there is one society, the American Institute of Chemical Engineers (AIChE), that draws academics to a core annual meeting. Hence, the women in the pilot summit had a continuing venue and numerous opportunities to meet and follow up on their peer mentoring activities.

However, an unexpected discovery was made about women engineering faculty inside other disciplines: not all women inside a given discipline knew each other because (1) they did not all attend the same conferences; and more poignantly, (2) they were isolated even inside of the academy because of the small numbers of women engineering faculty in each discipline.

The pilot summit became the catalyst for setting up peer mentoring networks in other engineering disciplines, which then grew to a more global discipline inclusive peer mentoring network initiative. This is what the 3 summits eventually came to represent, a grouping of women that connected through a common experiences at the intersection of race and gender that transcended disciplines.

Out of this grew the roadmap for the Peer Mentoring Summits for Women Engineering Faculty of Color that was funded by NSF in 2006, to draw together participants representing the spectrum of engineering disciplines. The women were recruited from both Top 50 institutions (based on research expenditure) and non-Top 50 institutions from across the U.S., Puerto Rico, and the Virgin Islands; professional engineering organizations including Society of Hispanic Professional Engineers ( SHPE), American Indian Science and Engineering Society (AISES), National Organization for the Professional Advancement of Black Chemists (NOBCCChE), and others. The summits took as a premise the fact that the utilization of peer faculty groups to coach, mentor, encourage and advise each other can have a positive role in the success of individual faculty.



The three areas of emphasis that would govern the Summit discussion groups and working sessions were:

- (1) The realization that the institutional requirements and expectations in research, teaching, and extension were different for each represented school
- (2) The uniqueness of the experience for women of color had to be examined in the context of the intersection of gender and race in the academy
- (3) There was a need for this emerging network to develop a platform to make leadership at their respective schools aware of the unique opportunity to successfully diversify the women faculty in engineering.

The long term goal of the Summits was actively working towards qualifying women for promotion in academe, recruiting women in the pipeline to faculty positions, retaining women in faculty positions and equipping the women to pursue leadership positions, while gleaning from the group, perspectives that addressed best practices to achieve this end.

The summit participants consisted of women of color faculty members in various areas of engineering from throughout the country, PURPOSE Institute staff, and graduate student ambassadors. Participants were recruited from various engineering organizations including National Society of Black Engineers (NSBE), Society for Advancement of Chicanos and Native Americans in Science (SACNAS), American Indian Science and Engineering Society (AISES), Society of Hispanic Professional Engineers (SHPE), National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE), and American Society for Engineering Education (ASEE).

During all of the summits, including the first summit, faculty participants participated in a series of sessions that were geared towards professional development in engineering. The participants were asked to complete a demographics survey and summit session evaluations. After the summits, the participants were asked to complete a post-summit survey and a sample was to be selected to participate in a personal interview or focus group interview. The findings from the survey and evaluations were used to help create the agenda and session topics for future summits. There was a continuous dialog with the women to incorporate the issues and items that are critical in their own career development to guide the development of relevant programming.

### **Summit 1: 2007 ADVANCE Peer Mentoring Summit**

- The first Summit was held in June 2007 at NCSU in Raleigh, NC
- The 3 and a half day event was attended by 60 women of all ranks
- Participants rank profile: 8 full professors; 10 associate professors; 38 assistant professors; 4 instructor/research
- Engineering disciplines profile: 3 Biomedical; 7 Chemical; 5 Civil; 5 Computer Science; 3 Engineering ed; 1 Environmental; 12 Electrical; 6 Industrial; 1 Materials Science; 8 Mechanical/Aerospace; 1 Mathematics/Statistics; 2 Other
- Ethnicity profile: 42 African American (AA); 13 Hispanic (H); 0 Native American (NA); 5 Other

### Summit activities or Key aspects/workshops in the summit...

- Discipline Specific Work Groups: The workgroups allowed specific disciplines to identify the prevailing issues respective to their areas. Issues of discussion include promotion and tenure, mentoring, leadership, etc. These groups were charged to brainstorm on the path forward.
- ADVANCE-ENG to Women and Peer Mentoring in Resource Room: This special gathering is an opportunity for minority women faculty to interact one-on-one with aspiring girl engineers and their mothers. Participation was optional, but highly encouraged.
- “Life from a Compost Heap Pluck it Out? Leave it in?”: The goal of this exercise was to challenge them to utilize the debris in their lives to fertilize the life of someone else.
- Staying at an Institution: In this panel discussion, tenured professors shared their experiences regarding the decision to stay at or leave an institution. They discussed knowing when to stay, when to leave, and how to leave.
- So You Want to be a Leader Panel discussion: Current and former administrators provided insight on the transition from faculty to administration, the role of an administrator, and the transition from administration back to faculty.
- The Summit That Could Save Your Life!!: The purpose of this session was to evaluate the issues that hold faculty back either real or perceived in their careers. Responses to various interpersonal situations will be discussed relative to our position and our role in the academy.
- The Nifty-Top Fifty: This session reviewed the original premise of the ADVANCE Grant and covered the topic of the absence of minority women faculty at the top 50 U.S. institutions by research expenditures. The primary question here was whether it is important that there are URM women faculty at the top 50 schools. *It is also interesting to note that a number of the women faculty obtained at least one of their engineering degrees from a top fifty institution.*
- Work-Life Balance: The Toughest Decisions You'll Ever Face: This working lunch session focused on balancing your personal and professional lives. Faculty posed questions regarding work-life balance, while a panel answered the questions and provided best practices.
- Moving up the Ladder Towards Tenure: Panel of associate/full professors shared personal experiences and provided best practices for moving up in higher education.
- Talkin' to Each Other: Pre-Tenure and Post-Tenure (Associate/Full) These small group discussions were extensions of the previous session. The pre-tenure group focused on promotion to assistant to associate professor. The post-tenure group discussed issues surrounding promotion from associate to full professor as well as cross cultural/gender mentoring.
- Best Practices in Cross Cultural/Gender Mentoring: Fact Finding Mission This session is an extension of the post-tenure session ; the purpose was for post-tenure faculty to summarize their discussion on cross cultural/gender mentoring as well as facilitate best practices in mentoring.
- Carousel Development Sessions: This series of sessions provided faculty the opportunity to discuss pressing issues in a variety of areas including: managing your time, getting your point across in the academy, understanding the role of race and gender in the academy, and discussing things you wish you would have known before becoming a faculty member.

- Discipline Luncheon: Departments often labor under the notion that there are 'no URM faculty' out there and it is difficult to recruit them. At this luncheon the participants were joined by faculty and representatives from the Colleges of Engineering at Duke and NCSU to discuss mechanisms for recruitment, retention and championing of URM women faculty. The potential for inclusion in research center, education grants, and seminar invitations was an expected outcome.

## Goals

One of the goals of the 2007 summit was to address the following research questions:

1. Why are Women of Color not represented at the 'top 50' institutions?
2. Do Women of Color ever consider or actually seek out positions at these institutions? Why or why not?
3. Is it critically important for Women of Color to be represented at the 'top 50' institutions in order to be change agents in the diversification of the field?

Several data sources were used to collect this information including a forced choice and open-ended demographics questionnaire, summit session evaluations, summit evaluation, post-session evaluation, and personal interviews.

In addressing question #1, the participants were asked about their perspectives on why women faculty of color are not working at 'top 50 institutions. This information was captured through various sources including a demographics survey and discipline-specific discussions.

## Results/Findings

Several themes emerged when examining these data sources. The faculty discussed the following reasons as to why women faculty of color are not at 'top 50' institutions'.

1. Job searches sometimes want to check the box saying that they included women of color but based on the climate may not intend to actually hire the demographic
2. Women of color prefer to go where we are supported
3. Women of color often choose otherwise due to 'perception' of less pressure at non-top 50
4. Life goals of women of color often includes more than just the discipline of specific research community and education
5. The current faculty don't know what to do with women of color, how to treat us; how to mentor; how to extend normal collegiality; how to bring us into the 'male club'
6. Inadequate or incomplete mentoring experiences (women of color have to 'see themselves' there to pursue)
7. Location (do we want to be there; culture)
8. Reputation of institution with regards to women of color

The faculty also shared perspectives on the impact that women faculty of color would have at 'top 50' institutions. The themes in their responses included the fact that these women could serve as role models, be mentors of women and minorities, educate future leaders and change the perceptions, perspectives and climate regarding women engineering faculty of color. Overall, the participants voiced a variety of perspectives on women of color and 'top 50' institutions. They described how their experiences were based upon both their gender and racial backgrounds

### **Implications for next summit**

The themes in their responses included the fact that these women could serve as role models, be mentors of women and minorities, educate future leaders and change the perceptions, perspectives and climate regarding women engineering faculty of color reinforced the agenda for future summit content. Another realization discovered was that senior women engineering faculty faced additional challenges unique to leadership roles in the academy and directorates. The second summit was planned to identify these critical issues, to celebrate the achievements of excellence, and to explore the “next steps of my career

### **Summit 2: “ADVANCE-ENG with PURPOSE: Profiles in Leadership”**

- The second Summit, a mini-summit, was held in March, 2009 at NCSU in Raleigh, NC
- The 2 and a half day event was attended by 30 women of senior rank and in leadership positions
- Participants rank profile: 4 full professors; 14 associate professors; 12 assistant professors
- Engineering disciplines profile: 5 Biomedical; 2 Chemical; 2 Civil; 2 Computer Science; 1 Engineering Education; 0 Environmental; 5 Electrical; 3 Industrial; 3 Materials Science; 2 Mechanical/Aerospace; 1 Chemistry; 1 Mathematics/Statistics; 2 Psychology; 2 Adult Education
- Ethnicity profile: 18 African American (AA); 12 Hispanic (H); 0 Native American (NA)

### **Goals**

- (1) to stimulate collaborative efforts between senior URM faculty and administration to promote success of URM faculty in engineering and science,
- (2) to formulate strategies to broaden the impact of senior women faculty on the collective women URM faculty of all ranks in engineering and science;
- (3) to extract from these faculty trailblazers their perspectives on the best practices for the recruitment, retention, promotion and continued upward mobility into leadership for this same group in engineering academia;
- (4) to strengthen a strong peer leadership mentoring network and cohesive community that could serve as a powerful resource in the Academy;
- (5) to lay the groundwork and support for the second 2009 Summit (Summer 09) targeting women URM faculty of all ranks in engineering and science.

### **Summit activities or Key aspects/workshops in the summit**

The focus within this series of "summits and mini-summits" was improved retention and promotion into leadership of URM women faculty. URM Senior women faculty are very familiar with the unique race and gender issues; while progressing in their careers they are often called upon to mentor, guide, and advise students and junior faculty. This summit was targeted to empower senior women URM faculty through a series of interactive sessions, active mentoring by senior leadership, and brainstorming to collectively solidify the critical voice and associated leadership role they play in national areas such as the Engineering Grand Challenges, workforce, global technological needs, and university governance. The meeting initiated the formation of a network of peers to celebrate accomplishments, share strategies for success, and raise the bar even higher for all in the academy. While this was a much shorter meeting than the 2007 summit, there were important small group discussions with the participants and senior administrators at NCSU. The sessions included:

- “My Story...My solution”: Personal & academic testimonies from group and candid discussions on topics related to senior faculty growth and development.
- Making Connections @ NCSU: A time to interact with NCSU researchers and senior administrators in related discipline areas.
- Profiles in Leadership– a roundtable with Deans from Engineering and Physical/Math Sciences for Full Professors; Associate Professors met with members of NCSU Promotion and Tenure Committee on “Making it to Full – to there from here” .
- Innovative Opportunities in Academe & Preparation for leadership: Interactive sessions with former ACE & AAAS Fellows, NSF Program Managers, Upper Level Administrators, and Research Center Leaders
- “Yes We Did It---But We’re Not Done”: Celebration of Excellence Dinner with Special guest speaker, Dr. Harold Martin, Senior Vice President for Academic Affairs, UNC
- Achievement: There was a special recognition of the Summit URM Senior Women guests and their scholarly and mentorship contribution to the Engineering academy, as well as to the future of women in engineering as examples to K-12 students and women faculty in the academy;

### **Results/Findings**

A significant opportunity for participants of the smaller summit was the small group dialogs between the participants and senior administrators at NCSU. Critical discussions centered around work/life balance, dealing with issues of respect from administrators, colleagues, and students; and moving to the next career levels.

When asked why they were attending the “**ADVANCE-ENG with PURPOSE: Profiles in Leadership**” summit the women had a range of positive responses that included:

- Because is a way to learn about what other institutes are doing in order to provide advice and leadership to female professors. I am excited to be attending a conference of senior women of color; I look forward to learning/sharing in the best spirit of peer mentoring among those of us who have made some strides, but still want to accomplish (much) more..
- To be inspired! I am at a point in my career where I need to move on (more than ever) but need information, knowledge, and as mentioned inspiration to do so.
- I believe we still have a lot of work to do to increase entrance of women into engineering, but most importantly to have a path for/to sustainable leadership roles. And I would like to know how we can tackle the issues to better this situation and how I can help.
- I am newly appointed Dean of Science and Mathematics and hope to learn from the collective experiences of those gathered here.
- To reconnect with old friends and colleagues whom I haven’t seen in 10 years. To gain perspective and clarity on next steps for my career. To think and brainstorm about the future of engineering education.
- To share with and learn from the participants. My hope is that we all leave this summit energized and with new strategies as we continue to create our professional futures. I believe these women are the best mentors one can find in academia. I am just starting my

tenured-stage of my career and I hope to learn how to deal with issues that will come my way since they have already gone through that road.

- To network with others who have similar goals and backgrounds. To exchange ideas and strategies for career planning and advancement and handling situations that arise as a university administrator.

A post evaluation of the summit provided feedback on benefits of the summit on their personal and professional development. The responses included:

- The discussions in which we were engaged were helpful on defining what are the next step in our careers.
- I enjoyed the networking opportunities and the synergy between all the attendees.
- Opportunity to interact with other senior women to share best practices and ideas in addition to the fact that the participants had excellent expertise and that the conference structure allowed us to learn from each other
- The bond with the other participants and listening to senior NCSU administrators and the chance to have small group discussions with deans.

### **Implications for next summit**

A look back over the journey taken by the Senior Women Engineering Faculty collectively and individually allowed the women to identify crucial issues relevant to women engineering faculty of all ranks and to lay the groundwork for Summit 3. Reproducing the positive experiences of dialoging with senior administrators, celebrating achievements of excellence, and examining the pathways to promotion and leadership would be elements to empower the next group of participants to start to rethink about their own journey in the academy, through the eyes of those with demonstrated success in leadership.

### **Summit 3: “Navigating Your Journey on the Academic Sea**

-The third Summit was held in July/August at California Institute of Technology (Caltech) in Pasadena, CA and was co-sponsored by Caltech

-The 3 day event was attended by 59 women of all ranks

-Participants rank profile: 1 department head; 11 full professors; 15 associate professors; 23 assistant professors; 4 associate deans; 1 vice provost/dean; 1 managing director; 1 lecturer; 2 instructor/research professors

- Engineering disciplines profile: 1 Architectural; 8 Biomedical; 6 Chemical; 3 Civil; 5 Computer Science; 4 Engineering Education; 3 Environmental; 13 Electrical; 6 Industrial; 3 Materials Science; 6 Mechanical/Aerospace; 1 Chemistry; 0 Mathematics/Statistics; 1 Adult Education; 2 Other

-Ethnicity profile: 32 African American (AA); 18 Hispanic (H); 0 Native American (NA); 8 Other

The final summit entitled, “**Navigating Your Journey on the Academic Sea: A View from Within**” in 2009 co-sponsored by California Institute of Technology, NCSU and NSF invited URM Women Engineering Faculty of all levels to celebrate their accomplishments as respected scholars, professors, and researchers in engineering academe. We recognized that many of the women had risen to significant STEM and University leadership roles ( e.g., NSF Program Managers, Associate Deans/Deans, Department Heads, Center Directors, Vice Provosts, Interim



Administrators and well established, respected senior researchers) while others are still in the process of rising through the faculty ranks. This summit focused on women at Assistant, Associate and Full Professor levels with a special emphasis on the next steps in the process of connecting this community to each other and the engineering academy. One intention of the Summer 2009 Summit at Caltech was to glean and pass on the depth of wisdom from Senior Women Engineering Leaders who attended the Spring Summit. Respected women leaders such as President Marye Anne Fox (UC San Diego), Shirley Malcolm (AAAS), and President Ruth J. Simmons (Brown University) were featured in a special presidential roundtable and final banquet led by Caltech President Chameau. The women also had an opportunity to interact with and mentor URM graduate students and post doctoral students at Caltech interactive sessions.

### **Goals**

The theme of navigating your journey in this final summit explored the upward movement in the academy as seen from several different perspectives and challenged the speakers to reflect back on their own journeys, providing advice to conference participants.

### **Results/Findings**

The result was a powerful series of sessions that impacted the women participants at each professorial level and gave insights to those in leadership also. Using as subthemes: (1) The Quest – Looking at the Larger Landscape , (2) Cultivating Smart Choices for Academic Faculty , (3) Specific Skills to Align Your Compass for the Journey and (4) Making and Sustaining Connections the speakers and roundtable discussions all pointed the participants towards the development of a roadmap for their own careers. The summit leadership team also charged the women with continuing the development of their peer mentoring networks through their respective disciplines and professional organizations.

### **Conclusion: Critical Future Steps:**

Past efforts have focused on preparing the women in Science, Technology, Engineering and Math (STEM) with innovative approaches to confront and overcome any challenges through a combination of peer, cross cultural and technical mentoring. As a collective, URM women engineering faculty can be a resource to other universities, while advancing their own careers. This project was a direct outcome of the career experiences of the author and the impact that cross-cultural mentors made building positive experiences in her career. One of the authors credits a mini-sabbatical at the University of Minnesota supported by NSF's Professional Opportunities for Women in Research and Education (POWRE) program as a mechanism "jump-starting" a new research area. A similar supported mini-sabbatical at Caltech also created the collaboration for her ADVANCE Leadership Summit for URM faculty to be co-sponsored by Caltech.

This project was addressed using a multidisciplinary approach. The perspectives of both engineering and educational psychology were utilized to help address the proposed research questions. The summit series and presentations are forming the foundation for a series of best practices for recruitment, retention, mentoring, and promotion of women engineering faculty of color. The participants benefitted from the insight into their own feelings and beliefs that occur

when provided an opportunity to discuss, in-depth, their experiences regarding their careers in engineering.

A series of summits and conferences focused on career development in a number of NSF programs has been instrumental in the careers of several URM women faculty at a range of institutions. The summits provided a focused opportunity for the women to identify challenges, connect with new peer and senior mentors, recognize strategies for career success and solidify mechanisms to address personal and professional challenges, to insure continued success. Based on our faculty cohort and previous summits, there is a need for mechanisms to celebrate scholarly excellence and achievement while connecting URM women to a wider range of institutions. Overall, the summit participants voiced a variety of perspectives on underrepresented minority women and Top 50 institutions. They described how their experiences were based upon both their gender and racial backgrounds as well as described the difficulty of being both women and minorities within higher education. The initiatives described in this paper are beneficial to women faculty of color in engineering. At the core of these initiatives was the:

- (1) Identification of obstacles to the recruitment and retention of women engineering faculty of color.
- (2) Identification of critical needs for an interdisciplinary, multicultural faculty peer mentoring network.

Our efforts have focused on equipping the women with innovative approaches to confront and overcome any challenges through a combination of peer, cross cultural and technical mentoring. We have observed that in the past 4 years the status of the women faculty in this group of upwardly mobile leaders has been elevated in the academy. At the time of the original proposal several of the women were in the process of promotion towards either Associate with Tenure or Full Professor. A number of the others have obtained the rank of Full Professor and have been selected for leadership in the academy. It is the community of support nurtured by the Peer Mentoring Summits that is expected to provide the foundation for a lasting legacy of this group of women in the academy. For example, the fact that a number of the senior women are in administrative positions provides tangible examples of excellence that we celebrate and connect with our URM women engineering faculty. There has, however, been a limited engagement of upper administrators and university faculty in many programs outside of a panel discussion or formal presentation. Future efforts must be directed toward the strong need for a national engagement of women leaders at a range of institutions in a range of collaborative and individual scholarly activities with the aforementioned faculty/administrators. There is also a need to report back to the Engineering Deans on the outcomes of the initiatives proposed in initial meetings in 2005; some aspect of this will occur at the 2010 ASEE Engineering Dean's Institute in a special session on faculty diversity being presented by one of the authors.

We have also had extensive dialog with our underrepresented male counterparts about our initiative and a number of them have participated in broader PURPOSE Institute\*\* activities. In the future we would like to engage this group and explore activities that will connect them to a broader faculty community.

The next generations of initiatives must use this well laid foundation as the basis for leveraging this program to impact a wider set of institutions, engaging them in the dialog of change by engaging faculty at the next level. Faculty to faculty interactions will bring the professional

confidence/comfort in a group of technical and administrative leaders that would not otherwise interact with URM women STEM faculty. We believe that this will translate into a different perspective or comfort level with the faculty and administrators making hiring/promotion decisions. This may mean that a candidate that is an URM woman may not seem that “unusual” when her dossier comes across their desk. The hiring and eventual collegueship of URM then becomes the normal course of business due to a familiarity with women with a similar background; leading to a seamless transition and a smoother interaction at all levels of the academy from Assistant Professor to Vice Provost to University President. Then it becomes a matter of real, sustained relationships in which women become a part of the fabric of the university environment.

**Critical Next Steps** should include: Pushing initiatives out to academic institutions nationwide through targeted discussions with academic leadership, serving to promote change in the perception, recognition and acceptance of these women as respected, scholarly peers.

### **Acknowledgments of Collaboration**

There were 3 entities that provided the foundation of partnerships for the summits:

- ASEE Deans
- Task Force consisting of tenured URM women engineering faculty
- The PURPOSE Institute for Faculty Development

### **ASEE Deans**

#### **Connection in Initial Stages of Project**

The Engineering Deans are a critical link between faculty hiring and the department. While Deans often do not have major interactions with individual faculty, they can set the tone for hiring and promotion practices in the College. Our strategy has been to interface a credentialed (e.g., tenured) set of URM faculty leaders with Engineering Deans and eventually Department Heads to initiate honest dialog on the issues. But talking is only the first step. Deans and faculty are busy, so our approach has been to organize structured meetings that extract critical information from each group. The following is a description of the initiative organized to facilitate the Dean’s viewing PURPOSE as a resource to help them to recruit, retain and promote URM faculty; these activities formed the foundation for the ADVANCE grant and the resulting initiation of the series of summits.

PURPOSE has had three opportunities to formally present its programs to the Executive Group Engineering Dean’s Council, the general body of the Dean’s Council and in 2007 presented a paradigm-shifting interactive seminar providing insights in the experiences of URM engineering faculty at the Dean’s Leadership institute in Puerto Rico. This is a major milestone for the Institute; having the active participatory ear of the Deans at a national level is critical for the success of the Institute and programs aimed at diversifying the Academy.

- ASEE Engineering Deans Leadership Luncheon; June 2005: ASEE National Conference; Portland, Oregon: This invited presentation was made to introduce the Engineering Deans Executive Committee to the PURPOSE Institute. This was the first step in the development of an active linkage between PURPOSE and the ASEE Deans.

- ASEE Engineering Deans Luncheon; June 2006: ASEE National Conference; Chicago, Illinois: This invited presentation updated the Engineering Deans on the progress by the Institute in working on activities around faculty mentoring and development. There were approximately 30 deans in attendance at this meeting. As a result of this meeting – PURPOSE conducted a 2 hour formal presentation/workshop at the ASEE Engineering Dean’s Institute in 2007.
- ASEE Engineering Deans Leadership Institute (EDI); April 2007: ASEE EDI Conference: San Juan, Puerto Rico: PURPOSE conducted a 2 hour formal interactive presentation/workshop at the ASEE Engineering Dean’s Institute in Puerto Rico in April 2007. The “town hall” style meeting included between 5-7 URM faculty at the rank of Full Professor; many of whom have had administrative positions in the Engineering Academy.

An informal written survey of the Deans demonstrated their commitment to institutional change through a partnership with the PURPOSE Institute. The resulting increase in the recruitment, retention, and promotion of this group of faculty will benefit students, faculty and administrators alike.

### **\*\*PURPOSE Institute for Minority Faculty Development**

One established mechanism to implement the aforementioned needed initiatives is the **Promoting Underrepresented Presence on Science and Engineering Faculties (PURPOSE) Institute**; a direct result of both the NSF Presidential Award for Excellence in Science Math and Engineering Mentoring (PAESMEM) and National Academy of Engineering Boeing Senior Fellowship to investigate the development of a faculty development institute. The primary goal of the PURPOSE initiative is to *Empower Current and Aspiring Faculty to Achievement, Promotion and Leadership in the Academy*, focusing on URM and women engineering faculty members, with an express goal of promoting the recruitment, preparation and retention of URM faculty in the Engineering/Science Academy. The four components of the *Institute* providing just-in-time guidance and support for faculty and aspiring faculty are: (i) Think Tank of Successful URM STEM Faculty (II) Current Faculty Groups dialoging with Engineering Deans and Faculty Recruiting Committees, (III) Events (e.g., conferences/ workshops) to Celebrate and Empower Faculty, (IV) Information Resources for Faculty.












Since its inception, the PURPOSE Institute has discovered and drawn on the experiences of diverse faculty, forming a platform of encouragement/ inspiration for men and women faculty aspiring to navigate the ranks of their discipline. Through a series of peer-mentoring, cross-cultural and leadership summits the PURPOSE Institute has discovered that positive reinforcement and celebration of achievements is a powerful force in establishing URM men and women as a recognized, venerable, contributing group of scholarly leaders in the engineering professoriate. It is grassroots initiatives developed out of the experiences of URM faculty coupled with strong partnerships with university leadership that will “*broaden their participation*” and ultimately their success in the STEM Academy.

It’s essential to disseminate the PURPOSE Institute efforts resulting established networks in which URM women engineering find identity, mutual respect, and invaluable guidance. The PURPOSE Institute pushes these initiatives out to academic institutions nationwide through targeted discussions with academic leadership, and serves to promote change in the perception, recognition and acceptance of these women as respected, scholarly peers.

**Task Force consisting of tenured URM women engineering faculty**

Partnership with academic leaders throughout the US was important to provide critical connections to URM women engineering faculty with each other and the academy at large. An Advisory Task Force consisting of Senior URM women engineering faculty has provided guidance and oversight to the project throughout its development and execution. Through a series of conference calls, face-to-face meetings, and one-on-one consults with the project leaders, the Task Force enabled the identification and recruitment of a faculty representing a broad range of schools, school types (e.g., HBCU, HSI, Research One) and disciplines. The Task Force was also crucial in the development of Summit content, speaker selection in addition to providing leadership in specific sessions as facilitators and presenters themselves.

**Table 2: Task Force Team**

 <p><b>DR. MERCEDES A. RIVERO-HUDEC</b> Former Associate Dean of Students and Diversity, Associate Professor Chemical Engineering</p> <p><i>University of Rhode Island</i></p>	 <p><b>DR. KIMBERLY JONES (AA)</b> Associate Professor Civil Engineering, Deputy Director Keck Center for the Design of Nanoscale Materials for Molecular Recognition</p> <p><i>Howard University</i></p>	 <p><b>DR. ROBIN N. COGER</b> Professor and Former Interim Chair, Department of Mechanical Engineering &amp; Engineering Science Founder, Center Biomedical Engineering Systems</p> <p><i>University of North Carolina at Charlotte</i></p>
 <p><b>DR. LESIA CRUMPTON-YOUNG</b> NSF Program Director Professor and Former Chair Industrial Engineering</p> <p><i>University of Central Florida</i></p>	 <p><b>DR. VALERIE E. TAYLOR</b> Department Head and Royce E. Wisenbaker Professorship I in Engineering; Computer Science</p> <p><i>Texas A&amp;M University</i></p>	 <p><b>DR. KAREN BUTLER PURRY</b> Professor Electrical Engineering Assistant Dean of Graduate Studies</p> <p><i>Texas A&amp;M University</i></p>
 <p><b>DR. PATRICIA MEAD</b> Professor of Optical Engineering</p> <p><i>Norfolk State University</i></p>	 <p><b>DR. JOHN M. PARKERT</b> Associate Professor Mechanical Engineering</p> <p><i>University of Kentucky</i></p>	 <p><b>DR. RHONDA FRANKLIN DRAYTON</b> Associate Professor Electrical Engineering</p> <p><i>University of Minnesota</i></p>
 <p><b>DR. SONIA M. BARTOLOMEI-SUAREZ</b></p> <p>Professor of Industrial Engineering</p> <p><i>Univ. of Puerto Rico Mayaguez</i></p>	 <p><b>DR. PATRICIA B. ZARATE</b> Associate Professor of Industrial Engineering</p> <p><i>Polytechnic University of Puerto Rico</i></p>	

(For more information on the mission and history of The PURPOSE Institute, <http://www.che.ncsu.edu/purpose/> )

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