

## **Minority Student Retention: Importance of Ethnicity Based Technical Organizations for Students at Majority Institutions**

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### Abstract

It is widely accepted that one of the many institutional factors that negatively impact the retention of students of color is the scarcity of professional role models and minority faculty members. However, the significance of these relationships, particularly in traditional majority institutions, is vastly underestimated. According to the 1993 National Study of Postsecondary Faculty, African Americans made up only about 2.8% of full-time engineering instructional faculty and staff; Hispanics fared slightly better at 3.1% and American Indian/Alaskan Natives were less than one percent.<sup>1</sup> Thus, within the engineering academic community, a relatively small number of minority faculty members are available at undergraduate institutions nationwide. This paper explores the institutional support of minority student interaction with ethnic professional societies for students at a predominantly white institution to help compensate for the scarcity of minority faculty and professional role models. Undergraduate and graduate students from the University of Missouri – Columbia received supplemental financial support for attendance at the annual conference of the National Society of Black Engineers (NSBE) or the Society of Hispanic Professional Engineers (SHPE). Each participating student was required to prepare a report detailing his or her activities and impressions from this activity. The potential positive impact of such activities for students at majority institutions is evidenced by their responses and by their continued success in engineering.

### Introduction

The underrepresentation of students of color (i.e. African American, American Indian and Hispanic) in science, engineering and math has been the challenge of higher education for several decades. Recent legislative initiatives which would expand the immigration opportunities, and thereby increase the number of international professionals with engineering, computer or other high technology skills over the next few years, have served to underscore within the engineering community, the loss symbolized by this vast underutilized talent pool. Early initiatives designed to address recruitment, enrollment and degree production of underrepresented minority students have met more success in the former two than the latter.<sup>2</sup>

Any serious discussion of the factors that contribute to high attrition rates highlights a broad array of characteristics that are both student centered and institutional in nature. Given that approximately seventy percent of all underrepresented engineering students attend predominantly white institutions, ethnic isolation is a major institutional component.<sup>3</sup> Faculty-student interaction or the lack thereof, is another well-established factor that often exacerbates a student's sense of isolation. The scarcity of minority faculty, combined with limited exposure to

minority engineering professionals, results in further changes in student perspectives as noted by Seymour and Hewitt.<sup>4</sup>

Although they also welcomed offers of practical help or encouragement from all faculty, students of color described faculty of color as performing additional functions that were relevant to their persistence: they act as role models in bonding them to the major; act as reminders that people of all races and ethnicities can succeed; preserve cultural connections and understand cultural constraints; and by demanding high standards from students, demonstrate the fallacies of stereotypes.

The act of minority faculty mentoring minority students does not diminish other faculty-student interaction but rather emphasizes the benefits unique to role models of color, particularly in ethnically isolating environments.

Issues of retention for underrepresented students are critical to meeting demographic changes projected for the college-age population and the increasing demands of the technological workforce. A recent Harris Poll commissioned by the American Association of Engineering Societies (AAES) exposed serious problems in public awareness of engineering, particularly among women and minorities. Current population reports predict that by the year 2050, minority students will become the largest segment of the college-age population.<sup>5</sup> Faculty role models of color for this growing population will continue to be scarce in the immediate future. Of the engineering doctorates awarded from 1992-96, only 2.46% were African American, Hispanic or American Indian.<sup>6</sup> Even as faculty of color begin to emerge in greater numbers, present faculty reward systems hinder involvement with undergraduates. In view of the low doctoral production and large future demographic changes, one solution is for educational institutions to utilize minority organizations such as the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), and the American Indian Science and Engineering Society (AISES) to address some of the factors affecting the retention of students of color. These organizations can provide underrepresented students with a greater understanding of the engineering profession, a sense of cultural connection and the belief that engineering is a field in which they can succeed.

### Background

As the first institution of higher learning west of the Mississippi, the University of Missouri – Columbia (MU) is the largest and oldest campus of the state's major public research institutions. In 1987 the University became a Carnegie Research I institution and it continues to strive for national and international distinction for its research and educational programs. MU is primarily a residential campus with an average enrollment around 22,000 students. Over 80% of those enrolled are white. In recent years the population of underrepresented students has consisted of approximately 6% African American, 2.5% Asian, 1.3% Hispanic and 0.5% Native American. Non-resident aliens make up another 5% and approximately 2% are listed as Unknown. Figure 1 illustrates the total enrollment figures for the University from the Fall Semesters of 1993-1998. A study of retention and graduation rates for first-time freshman undergraduates from 1987 to

### MU Enrollment

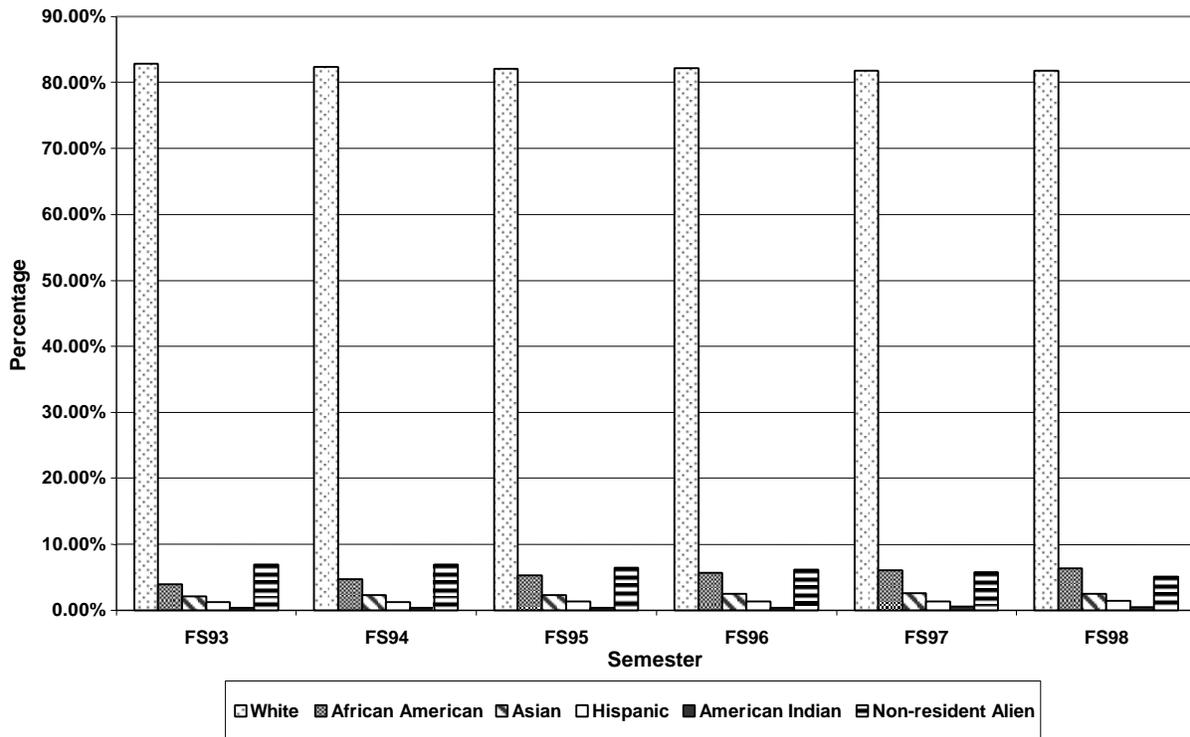


Figure 1. MU undergraduate enrollment by race/ethnicity.

1992 provides some University-wide statistics.<sup>7</sup> On average, 100% of students were retained in the first fall subsequent to enrollment. The numbers decline steadily thereafter: 80.23% in the second fall, 68.07% in the third fall, 63.15% in the fourth and 59.94% in the fifth fall. The average four-year graduation rate was 28.71%, and the numbers increased to 53.32% after year five and 56.97% after year six.

In recent years, the University has begun to recognize the growing importance of the underrepresented segments of the student body, particularly in the areas of science, math, engineering and technology (SMET). One of the early initiatives was the Access Enhancement Program (AEP). The purpose of AEP, supported by the U. S. Department of Education, was to provide financial and academic support to undergraduates from Historically Black Colleges and Universities (HBCUs) within a summer research experience. Two current indicators of change are the Heartland's Alliance for Minority Participation (HAMP), funded in part by the National Science Foundation, and the Diversity in Engineering Program (DEP). The HAMP program began in 1995 and presently consists of a partnership between the University of Missouri System and its four campuses, four state universities, two community colleges, the Missouri Coordinating Board for Higher Education, the Missouri Department of Natural Resources and the Missouri Department of Conservation. HAMP has two primary goals; first to increase the number of underrepresented students who complete baccalaureate degrees in SMET disciplines, and secondly, to increase the number of underrepresented students receiving graduate degrees in

these areas. During the initial years of the program, HAMP exceeded its baccalaureate production goals and is well within reach of its overall five-year goal.

The College of Engineering created DEP in 1996 in an effort to develop an environment that addresses the needs of underrepresented students and in turn, creates an atmosphere that is “user friendly” for all students. One of the initial tasks of the DEP program was to increase retention in the College, and to improve the perception of the College in under-served communities. Unlike the overall student population, enrollment within the College has begun a process of gradual change. The African American student population has grown from a low of 2.9% to approximately 5.9% in the fall of 1998. The Hispanic student population has increased from less than 1% to almost 1.65%. Although still less than 1%, the American Indian population has increased from a low of 0.1% to its present level of 0.4%. Figure 2 illustrates this gradual change. Except for the first fall numbers, retention rates determined by the 1987-1992 study for the College of Engineering differed slightly from the University-wide averages. The average number of all students retained in the College of Engineering for subsequent years were: 77.80% in the second fall, 67.08% in the third fall, 64.24% in the fourth fall and 61.62% in the fifth fall. The graduation rates for the College of Engineering were all lower than the University averages: 15.32% by the end of the fourth year, 49.17% by the end of the fifth and 55.82% by the end of the sixth year. A similar study of progression rates for first time engineering undergraduates by race/ethnicity beginning with the Fall semester 1993 cohort has begun.

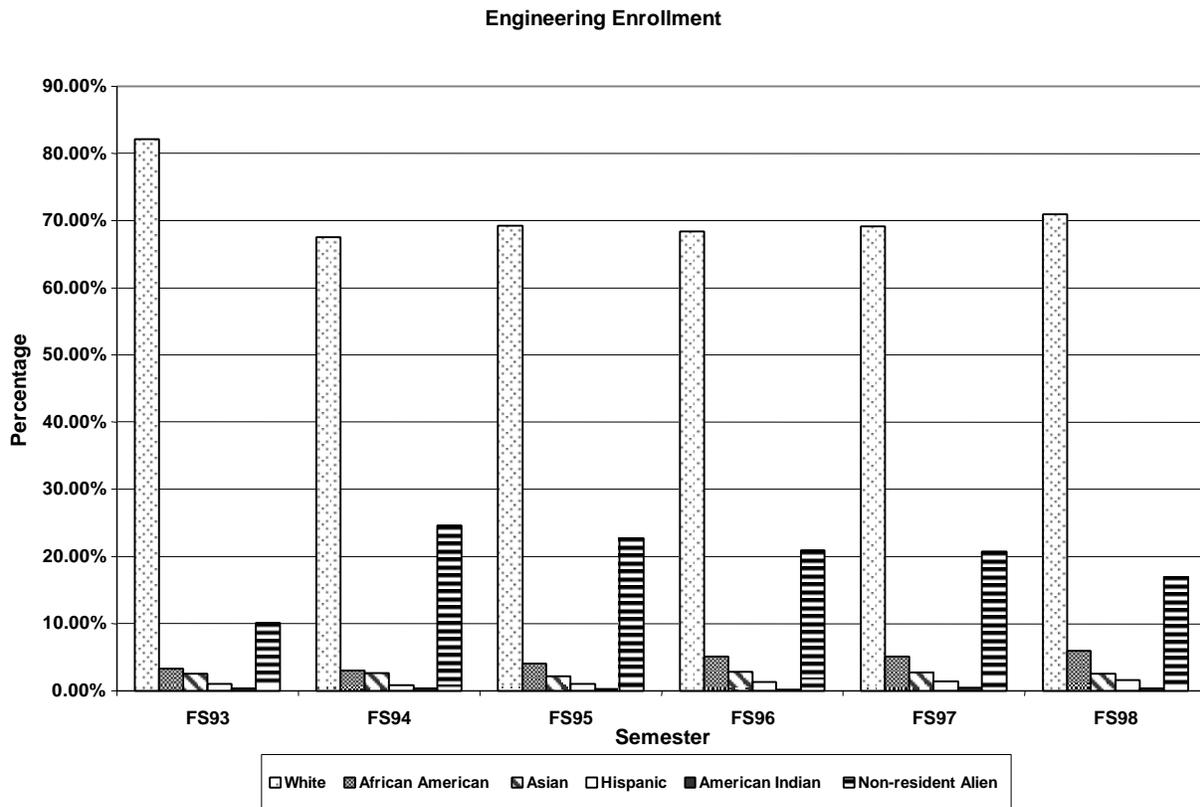


Figure 2. MU College of Engineering undergraduate enrollment.

## Activity Description

The activities which are the focus of this article were jointly sponsored by HAMP and DEP as a means to provide exposure to larger numbers of underrepresented students with similar interests, to provide exposure to professional role models and minority faculty members, and to increase consideration of a graduate education. The anecdotal evidence presented in this article emphasizes the significance of these types of activities for many underrepresented students.

The MU Chapter of the National Society of Black Engineers (NSBE) has been a recognized engineering student organization since the mid 1970s. However, the chapter has remained small by comparison (approximately 20 paid members) with other engineering and campus organizations. During the spring of 1997, the MU Chapter of the Society of Hispanic Professional Engineers (SHPE) was organized around a core group of about 10 students. As small organizations, each chapter receives minimal financial support from the Missouri Students Association through the Student Organizations Allocation Committee (SOAC). Although NSBE and SHPE have as organizations, worked hard to reduce the costs associated with their national conferences, these expenses still produce financial hardship for many students. In the activities described herein, the financial burden for individual students was reduced substantially.

Participating students ranged in level from freshmen to graduate students. The responses detailed are associated with trips to the NSBE conferences in Boston, MA (1997) and Anaheim, CA, (1998) and the SHPE conference in Orlando, FL (1998). Each student was required to submit a resume, attend a minimum of two workshops, and submit a trip report detailing their impressions and activities during the conference. A total of 33 students participated in these trips. This included three graduate students and two non-engineering majors. Twenty-seven students attended NSBE conferences and six attended the SHPE conference. Of the engineering majors:

- Four students attended both NSBE conferences.
- One student has since switched to a non-technical field.
- One student has left the University but continues to pursue an engineering degree.
- Two have left the University for academic reasons.
- All graduate students received baccalaureate degrees from Historically Black Colleges and Universities (HBCUs).
- Nine students have already completed their degree programs.

## Student Responses

Student responses were in general, remarkably candid and shared several common themes. The value of such short but relatively intense exposure to NSBE and SHPE at the national level was reflected in these themes, each of which factors into the complex goals of retention and graduate education. Although the campus organizations encourage social and academic interaction between minority students on a local level, in an isolating environment there is no mechanism for effectively communicating the engineering profession and the future potential of the student. The critical mass of other individuals at an academic or industrial level with whom the student shares a common background or culture, changes the student's perspective regarding information and issues. The very existence of these individuals was a theme common to all participants and

impacted significantly the self-esteem of the students. An extension of this was the recognition by the student of the value of a role model or peer mentor. Another theme observed concerned the importance of academic coursework and its relevance to the engineering profession. Students were able to make connections between their studies and the wide range of opportunities available. In many cases, the idea of a graduate education became more palatable to the student. The final recurring topic concerned the financial aspects of the trips. It is important to note that many students held some type of job to allow them to meet their financial needs and obligations allowing little room for additional costs. Furthermore, as small campus organizations, they receive little significant funding. The costs of supplementing such trips for students of color are relatively small compared to the future costs of attrition and declining enrollments. Responses listed here have been edited for spelling but are otherwise the exact words of the students.

### Impact of Engineering Students

Given the environmental isolation of these students, it was not unexpected that almost all students expressed a sense of amazement at the sheer numbers of students who shared their interests and backgrounds. What was not anticipated was the obvious effect of media sounds and images in their perception of others like themselves and the interest of potential employers. The psychological effects of the media and changes in affirmative action and equal opportunity programs were reflected in their choice of words and phrases.

When I got there, it was so amazing to me to see thousands of young black people who is interested in engineering. I became happy inside because I have never been expose to that type of environment before. Every time I saw a group of black people in one area, there was trouble. Everyone there was on one accord and about taking care of business. So, now I know there are some civilized black people.

Well before I begin I would just like to say that I really enjoyed myself and it felt really good to be around so many smart, clean, and intelligent black young students.

I was so excited the first day of the convention. Everywhere I turned there was another young black person in search of prosperity. I have never gone to a convention where there was a group of black people trying to actually get somewhere in this world. I think that was the highlight of my trip along with having the opportunity to meet the most interesting people from all over.

But the biggest success of the NSBE 24<sup>th</sup> Annual National Convention was the positive atmosphere created and the diversity represented by all those in attendance. There were close to 10,000 persons registered in California all making an effort to better themselves and impact society. This is not the normal view and statistics we receive from news and media. It is unfortunate that they were not present in Anaheim, because they would not have seen shooting or fighting. Instead they would have witnessed productivity and unity. Ten thousand black people, young and gifted; learning from the past to engineer the future.

I left the conference knowing that like me are others who have been able to succeed in the technology arena. A comforting fact now that I am about to graduate and become a professional myself, but most of all it was encouraging to see more than 3,000 Hispanics with the same purposes: to involve ourselves in the future, and to show the world that we have a lot to offer.

It felt good to meet people of my own ethnic background. It reminded me of where I came from and that there are others just like me out there.

### Impact of Industrial & Academic Professionals

Students reported comparable awe and excitement in response to exposure to industrial and academic professionals. It should be noted that much of the information which students felt they had obtained was deemed to be more credible and of greater significance because of the source. The veracity of this concept is debatable however, the fact that the students believe this to be true is significant. The isolation at a predominantly white educational environment and the on-going changes in affirmative action offer little to remedy the situation. After attending technical sessions and panels, many students indicated a change in their self-confidence and their approach to the engineering profession. They expressed a belief that they better understood the requirements and qualifications necessary for the next step in their career.

I was also invited to a private party with FMC. I got a chance to talk to several representatives. The atmosphere was very laid back and everyone was having fun. The representatives were impressed that a freshman was so interested in a career so young. When I finally left the party I felt really good about myself and that I had accomplished something.

Attending the SHPE NTCC Conference in Orlando, Florida gave me a much better idea in how to better market myself as a future professional to industry and graduate schools. I received numerous feedback from recruiters from both the private sector and graduate schools in how to go about strengthening my resume and/or graduate school applications. I found this to be more helpful than the resources that I have available at my university since it was the actual recruiters giving me their insight.

One of the seminars that I attended, discussed the advantages of having a professional Engineering License. The presenter has had his license for about fifteen years now, and he explained how to go about getting one. ... In California, only Thirty-seven percent of the Electrical Engineers passed the exam. That's not good news for me, but I do not plan to be another statistic.

Having attended various conferences, I feel I am a very qualified critic. It was very exciting to be amongst so many Professional Latinos. ... I was able to meet many young upcoming professionals as well as already established professionals.

He spoke of how he climbed his way to the top and persevered through seemingly impossible obstacles. It showed that it didn't matter what your ethnic or financial background is; you can become whatever you want if you're willing to work hard at it.

### Impact of Role Models & Conference Attendance

Several upper class students directly addressed the benefits of having a role model and the advantages of conference attendance. Many expressed a desire to become a role model or mentor for fellow students now and in the future. The participating graduate students and upperclassmen became unofficial mentors for the undergraduate students and these relationships often continued beyond the length of the trip.

As a minority in the sciences, I found myself struggling at points. I believe that having a role model would have given me support throughout my undergraduate schooling thus making it much easier to handle the school load, personal growth, etc. Our future generations need somebody who cares in order to succeed in education and in life in general and I want to be one of those who care.

Participation during the freshmen and sophomore years is essential. I think it gives the students at MU a sense of hope and motivation. When you are surrounded by intelligent people of the same ethnicity as yourself you feel secure and confident. Personally, after attending my first convention I was overwhelmed by the number of future African American engineers.

I talked to a lady from Mississippi State and she helped me to understand how the graduate programs work and the importance of a good mentor.

The influence of professional role models was particularly positive for the female students who participated. This was true for both the NSBE and SHPE female students. A recent report estimates that in 1995 women comprised approximately 9% of the engineering workforce.<sup>8</sup>

I was really encouraged by a particular one [workshop], Empowerment of the Latino Women. Seeing women involved in the engineering field encouraged me. It gave me the power to continue this battle.

Lastly, the highlight of this convention to me was having the opportunity to see Dr. Mae Jemison, the first black woman astronaut to go into space aboard the Space Shuttle Endeavor. Hearing Dr. Jemison speak during the closing banquet was very enlightening for me as a black female engineer. She gave me the inspiration to believe that I can achieve great heights in this male domineering field. One day, I have a dream to make an impact on this society as well as to my race in the area of science and engineering.

At Opening Session, I met the seventh Secretary of Energy, Hazel R. O'Leary. The keynote speaker was Dr. Mae Jemison. Both of these women gave me inspiration to continue on in a tough field such as engineering.

### Impact of Technical Sessions & Graduate School Exposure

Another common theme expressed in the student responses was a change in attitude towards their academic life in general and the possibility of a graduate degree. Students seemed more

able to connect their coursework with future engineering activities after attending various workshops and panels. The ability to make such connections is critical to the student's continued interest in engineering, and therefore, critical to retaining the student. As students became more acquainted with the variety of options available in engineering and more comfortable with the content of their coursework, they often became more open to the possibility of a graduate education.

It also made me serious about the things I do now in college. It's as if I look at college from a whole different perspective. When I first came to school, I just wanted to get by. It did not matter to me if my grade point average was high. My main focus was getting in and getting out.

One question asked [of the panel was] about how the classes you take in college relate to the task you perform on your job. For this question each panelist related certain topics which they had learned in college to the technologies they were developing on the job. I personally found this topic very useful and informative.

I believe the main focus was on how to be successful. Whether in school or on a job. I will be the first to admit that I learned a lot. For instance, I did not think having a master's degree would make a whole lot of difference as far as salary wise. Now I am at the point of considering graduate school.

Now, I want to attend graduate school and finish the education I need to be able to succeed in my areas of interest: biomedical sciences and veterinary medicine.

### Impact of Financial Assistance

The final common thread in the student responses concerns the financial component. It is important to note that participating students were not given a free ride unless their academic status was exceptional. Most students contributed some of their own funds in order to participate. It should also be noted that the financial concerns of the students included things such as lack of luggage and worries about appropriate clothing. Institutional support is critical to reducing the associated costs of these types of activities for students. As previously stated, almost all of the participating students were employed in some capacity to meet existing financial demands. Without the additional support of HAMP and DEP, the cost of these trips would have been prohibitive for many students and the positive effects of the experience lost. The following responses are typical of many students.

The whole event was life changing. I got to know students and companies from across the nation. I am utterly thankful for being able to attend, without financial support I would never have been able to experience the SHPE National and Technical Career Fair.

I would like to thank the necessary parties for providing round-trip travel and hotel accommodations. For without them, it would not have been possible for me to attend the conference.

The trip to California was an experience that I enjoyed, and I would like to thank all those who made it possible. I learned some things that will benefit me in the future, and reinforced things that I use everyday.

## Conclusion

In view of the scarcity of minority faculty and professional role models on most traditional campuses, the potential impact of national organizations like NSBE, SHPE and AISES in improving the retention of minority students in science, engineering and math is tremendous. The two years of anecdotal evidence presented herein provides insight into the students' views of themselves and their place in the engineering profession. Interaction with other individuals with whom they share common experiences and backgrounds enhanced the interest, determination and aspirations of the students. This activity provided an important key to understanding these issues from the student perspective. As retention is a complex issue, this is by no means offered as an absolute solution, nor a representation of the views of all students of color. However, the themes common among their responses suggest possible avenues of approach. The slow progression in minority doctoral production and the changing population demographics, demand that educational institutions take concrete steps to address the issues. The national conferences of professional organizations offer a low cost means of supplementing state and national programs such as HAMP, and institutional retention efforts.

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## Biographical Information

INGRID ST. OMER is currently a Research Associate and President's Postdoctoral Fellow at the University of Minnesota. Prior to earning her doctorate she worked in industry on Application Specific Integrated Circuits (ASIC) at Rosemount Inc., in Eden Prairie, MN. After attaining the rank of Senior Engineer and Engineering Supervisor, she attended the University of Missouri-Columbia (MU) to pursue a Ph.D. in Electrical Engineering. Upon completion of the Ph.D. degree, she served as a Visiting Assistant Professor in the MU Department of Electrical Engineering.

CHARLES SAMPSON is currently Interim Dean of the Graduate School at the University of Missouri-Columbia. His research in the area of human resource development, minority participation in the academy, minority participation among public sector professions, policy analysis, comparable worth, pay equity and public policy appears in journal articles and textbooks. He teaches in the areas of intergovernmental relations, federalism, and public policy and administration. He serves as principal investigator for projects funded by the National Science Foundation and U. S. Department of Education. He earned the doctorate in Urban and Regional Planning from University of Pittsburgh and has served as faculty and administrator at the University of Illinois-Springfield, Tennessee State University and Southern Nevada Community College.

MICHAEL LEE is the Director of the Diversity in Engineering Program (DEP) at the University of Missouri-Columbia, which supports 33 students financially and 319 academically. The DEP office is currently working to improve the educational partnership between MU and public school systems, as well as collaboratives with Minority Serving institutions, Historically Black Colleges and Universities, and Tribal Colleges and Universities. He hopes to mirror the successful efforts that he enjoyed with the NASA Training Project and others while at the University of New Mexico. Lee has served as a consultant to more than 30 organizations/agencies in the past eight years, and has been active in both campus and national groups promoting opportunities for underrepresented, under-served, and under-utilized populations.