DIVERSITY

IN THE MINERALS, METALS, AND MATERIALS PROFESSIONS (DMMM1)

FINAL REPORT:
THINKING GLOBALLY

Diversity in the Minerals, Metals, and Materials Professions

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Final Report: Thinking Globally

A Report on the First TMS Summit on
Diversity in the Minerals, Metals, and Materials Professions.

The Minerals, Metals & Materials Society
Warrendale, PA 15086

www.tms.org

The Minerals, Metals & Materials Society (TMS)

*Promoting the global science and engineering professions
concerned with minerals, metals, and materials*

The Minerals, Metals & Materials Society (TMS) is a member-driven, international organization dedicated to the science and engineering professions concerned with minerals, metals, and materials. TMS members number approximately 12,000, live in more than 70 countries on six continents, and include engineers, scientists, researchers, educators, administrators, and students.

To facilitate global knowledge exchange and networking, TMS organizes meetings; develops continuing education courses; publishes conference proceedings, peer-reviewed journals, and textbooks; and presents a variety of web resources accessed through *www.tms.org*.

The society is committed to advancing diversity and inclusion in the minerals, metals, and materials professions, a position formalized in the TMS 2018 Strategic Plan.

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Acknowledgements

The Final Report on the Summit on Diversity in the Minerals, Metals, and Materials Professions is the outcome of a July 2014 conference held at the National Academy of Sciences Building, Washington, D.C. The summit would not have been possible without the valuable contributions from professional societies, government agencies, corporate partners, and individuals.

Sponsor: The Minerals, Metals & Materials Society

Co-sponsors: TMS would like to acknowledge the generous support of the American Institute of Mining, Metallurgical, and Petroleum Engineers, which provided the initial sponsorship of the event. The full list of co-sponsors includes:
- American Institute of Mining, Metallurgical, and Petroleum Engineers
- Department of Energy, Basic Energy Sciences[*]
- National Academy of Engineering
- Society for Mining, Metallurgy & Exploration
- Society of Women Engineers

Corporate partners contributed significantly as well. Those partners are:
- Battelle Memorial Institute
- Newmont Mining Corporation
- Caterpillar
- Ford Motor Company
- General Motors Company
- TimkenSteel Corporation

Endorsing organizations were American Association of Engineering Societies; American Institute of Chemical Engineers; Association for Iron & Steel Technology; Association for Women in Science; The American Ceramic Society; Society of Hispanic Professional Engineers Foundation;

and University Materials Council.

The event, and this report, are the result of efforts by the following summit organizers:
- Elizabeth Holm, Carnegie Mellon University (Chair)
- Viola Acoff, University of Alabama
- Eliana Fu, Titanium Metals Corporation
- Mary Korpi, Newmont Mining Corporation
- Alexis Lewis, National Science Foundation
- Kray Luxbacher, Virginia Polytechnic Institute and State University
- Jonathan Madison, Sandia National Laboratories
- Michele Manuel, University of Florida

In addition, advisory organizers who contributed to the conference were:
- Wayne Jones, University of Michigan (Advisory Committee Chair)
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- Cynthia Belt, Independent Consultant
- Keith Bowman, Illinois Institute of Technology
- Ellen Cerreta, Los Alamos National Laboratory
- Julie Christodoulou, Office of Naval Research
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- Tresa Pollock, University of California, Santa Barbara
- Jonathan Ransom, National Aeronautics and Space Administration
- Linda Schadler, Rensselaer Polytechnic Institute

Thought Leader Preface

By now it's common knowledge that a diverse environment enhances creativity, innovation, and productivity in the workplace. However, like other science and engineering disciplines, our profession remains far less diverse than society as a whole. This report reinforces the fact that there is still significant room for improvement when it comes to creating diverse and inclusive workplaces in our field. As 2013 TMS President, I resolved to take steps to address this issue, and helped create the First TMS Summit on Diversity in the Minerals, Metals, and Materials Professions, held in Washington, D.C. from July 29–31, 2014.

Diversity can take on many different forms but this summit focused on issues related to gender and, race. These topics were not meant to encompass all of the diversity and inclusion issues that face our profession, but rather to promote a tractable, productive discussion on key challenges in our field. Similarly, due to the length of the summit being just 2½ days, the event also focused primarily on professionals—from those who are in early career to leadership stages. While there remain many diversity and inclusion challenges in K–12 and higher education, the focus on professionals enabled discussion among a group that has a tremendous capacity to improve diversity and inclusion in the workplace environment.

The summit's topics and speakers focused largely on the minerals, metals, and materials professions in a format that was intentionally participatory and interactive. It was designed for everyone—not just underrepresented groups—and involved attendees from government, academia, and industry to promote sharing of best practices. Participants gained skills and heard solutions that were intended to produce tangible results in their respective organizations. The participants' thoughts and voices helped develop the outcomes of the summit, which are captured in this report. It is meant to serve as a reference for those who attended the summit as well as others who want to learn more about

what was discussed during the event. A companion toolkit is also available on the web (*www.tms .org/diversityreport*) for those who would like to explore additional ideas on improving diversity in their workplace.

The event would not have been possible without the hard work of many individuals: TMS and Society for Mining, Metallurgy & Exploration (SME) volunteer organizers, TMS staff, invited speakers, and panelists. Thanks also to our generous sponsors: American Institute of Mining, Metallurgical, and Petroleum Engineers; Department of Energy, Basic Energy Sciences; National Academy of Engineering; SME; Society of Women Engineers; Battelle; Newmont Mining Corporation; Caterpillar; Ford; GM; and TimkenSteel Corporation. Their engagement and contributions enabled the success of the summit and through its outputs are helping support diversity in the months and years ahead.

Ellen Swallow Richards was the first woman in our profession and she overcame tremendous adversity on her way to a successful career. It was her story that helped inspire the summit and I hope her pioneering spirit motivates you to make an impact on your profession and to become part of the growing network of individuals who are promoting a more inclusive workplace.

Sincerely,

Dr. Elizabeth Holm

2013 TMS President

Summit Organizing Committee Chair

Conference Structure At-A-Glance

Tuesday, July 29

09:00 – 09:30	Welcome and Opening Remarks
09:30 – 10:10	Opening Plenary: "The State of Diversity in the Profession" - Mary Galvin
10:10 – 10:30	Break
10:30 – 11:00	Industry Keynote - Dawne Hickton
11:00 – 11:30	Academia Keynote - Linda Abriola
11:30 – 12:00	Government Keynote - Johnnie DeLoach
12:00 – 12:40	Panel Discussion with Keynote Speakers
12:40 – 02:00	Lunch Break
02:00 – 03:30	Facilitated Working Session Breakouts on Government, Academia, and Industry
03:30 – 04:00	Break
04:00 – 05:30	Facilitated Working Session Breakouts on Government, Academia, and Industry
05:30 – 06:00	Summit Dinner Reception
06:00 – 08:40	Summit Dinner: A Celebration of the Life and Legacy of Ellen Swallow Richards

Wednesday, July 30

09:00 – 12:30 (Break 10:30 - 11:00)	Simultaneous sessions: • Panel Discussion/Working Session - Early Career • Panel Discussion/Working Session - Leadership I • Expert-led Training Session - J. Mavrelis/T. Kochman • Expert-led Training Session - V. Young
12:30 – 02:00	Lunch Break
02:00 – 05:30 (Break 3:30 - 4:00)	Simultaneous sessions: • Panel Discussion/Working Session - Mid-Career • Panel Discussion/Working Session - Leadership II • Expert-led Training Session - J. Mavrelis/T. Kochman • Expert-led Training Session - V. Young
05:30 – 07:00	Networking Reception

Thursday, July 31

09:00 – 10:00	Closing Plenary - Mildred Dresselhaus
10:00 – 10:30	Break
10:30 – 10:50	Summit Highlights - Elizabeth Holm
10:50 – 11:40	Closing Dialogue - Viola Acoff, Dianne Chong, Wayne Jones
11:40 – 11:50	Closing Remarks - Elizabeth Holm

Executive Summary
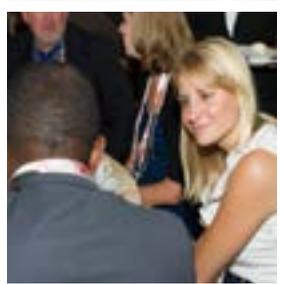
The First TMS Summit on Creating and Sustaining Diversity in the Minerals, Metals, and Materials Professions, (DMMM1), was held in the historic National Academy of Sciences Building on July 29–31, 2014 and proved to be groundbreaking in many ways.

Offering a synergistic mixture of keynote presentations from leaders in the field, panel discussions, facilitated workshops, training modules, and peer-to-peer networking functions, this innovative summit provided attendees with a unique opportunity to gain greater insight and contribute to recommendations for solutions on a critically important, though often neglected topic. Participants walked away with practical ideas to help create and sustain diversity and inclusion in their organizations. More specifically, panel discussions and working sessions focused on key diversity and inclusion challenges in the workplace and included individual sessions specifically aimed at the early-career, mid-career, and leadership levels. Multiple state-of-the-art training sessions from well-known and respected experts in the field of diversity and inclusion also provided professional development opportunities for anyone in the profession.

Approximately 120 attendees participated in DMMM1. They spanned all career stages and represented the three main sectors of the minerals, metals and materials profession in the United States—government, academia, and industry. Over the three days, attendees representing different backgrounds and experiences heard stories about real-world situations in terms of managing and mitigating diversity in the workplace, and participated in interactive discussions about what does and does not work well in a professional environment.

An overarching goal of DMMM1 was to provide a meeting that was both practical and authentic, including the latest information and thought leadership, along with some novel as well as tried-and-true skills and tools for solving today's real issues and the challenges that lie ahead. The hope of TMS, the sponsors, and the pioneering organizers who assembled the summit was that attendees would leave the event armed with fresh ideas and some practical action steps, along with new contacts and rekindled friendships, feeling empowered to make diversity happen in their work environments.

An equally important goal of the summit was to capture the valuable content developed at DMMM1 in the form of tangible outputs that would live well beyond the summit, and benefit a significantly larger group than just the people who were able to attend. These tangible outputs include this final report, and a complementary online diversity toolkit that can be found at *www.tms.org/diversityreport*

By actively participating in working sessions that harnessed the power of individual and group discussions to identify challenges, strategies, resources, and recommendations, the intent was also for the DMMM1 attendees to become part of the solution. To foster these sentiments and to lay the groundwork for future summits, the key findings and ideas from the groups were captured and documented in this final report so that attendees and non-attendees alike could use it to make a difference in their workplace and beyond.

Several key themes eventually emerged as DMMM1 began to draw to a close:

- **Mentorship:**There are many kinds of mentors, from so-called "mini mentors" to "role models" to mentors who don't even know that they are being mentors. All play an important role throughout one's career development.
- **Work-life balance:** Across government, academia, and industry, issues about having a "whole life" came up again and again among attendees.
- **Community:** Attendees commonly spoke about the desire to foster a sense of community as key to developing an inclusive workplace environment.
- **Awareness:** Most attendees agreed that a key step in addressing diversity issues in the workplace is maintaining one's own awareness and helping make others aware of problems and potential solutions.
- **Vigilance:** The community must work hard to keep watching, keep measuring, and keep improving the state of diversity and inclusion in the workplace.

These themes were heard throughout the summit in multiple sessions. While attendees gained insights on many of these issues, it is the intent of this final report to bring those lessons to a larger audience to ultimately help in creating and sustaining diversity and inclusion in the workplace.

Opening Plenary And Keynote Presentations

One plenary and three keynote speakers began the first day of the summit:

- **Opening Plenary**
  "The State of Diversity in the Profession"
  Mary Galvin, *National Science Foundation*
- **Industry Keynote**
  "Diversity Today: What Does It Mean, and Why Does It Matter?"
  Dawne Hickton, *RTI International Metals*
- **Academia Keynote**
  "Attracting and Retaining Women in Engineering and the Physical Sciences: The Academic Experience"
  Linda Abriola, *Tufts University*
- **Government Keynote**
  "Diversity in Materials Technology: A Navy/Government Perspective"
  Johnnie DeLoach, *Naval Surface Warfare Center*

Data set the tone for the opening plenary and subsequent panel discussions and working sessions on day one of the summit. Mary Galvin's presentation on diversity in science, technology, engineering, and mathematics (STEM) reviewed quantitative data that revealed a significant disparity in the demographics of the students and employees in STEM disciplines, versus the overall demographics of the U.S. population. The situation is improving, at least for women, as Galvin and others pointed out. But there are two key challenges to improvement, set forth in the opening plenary and carried through each of the keynote talks:

- How can the profession as a whole leverage the advances made by women to include the underrepresented groups in our field—African Americans, Hispanics and Native Americans— who have not shown the same improvement over the same years?
- How do we adjust goals, tactics, and metrics as we achieve success, and thus continue to gain ground for women as well as other underrepresented groups?

As shown in the following summaries, the opening speakers represented different areas of minerals, metals, and materials engineering, but all offered information and recommendations that could be applied in any workplace to further the causes of diversity and inclusion.

Pictured on left are the speakers and moderator from the opening keynote session. From left to right: Linda Abriola, Johnnie DeLoach, Dawne Hickton, and Wayne Jones.

OPENING PLENARY:
THE STATE OF DIVERSITY IN THE PROFESSION

Above: Mary Galvin, Director of the Division of Materials Research, National Science Foundation.

Mary Galvin, director of the Division of Materials Research at the National Science Foundation (NSF), kicked things off with the summit plenary talk, "The State of Diversity in the Profession." Galvin's presentation relied heavily on NSF data to describe the current state of diversity in science and engineering, which has shown stagnant improvement on multiple fronts including gender, race, and many other categories.

The obvious conclusion, she said, is that the science and engineering professions, including the community of minerals, metals, and materials professionals, are not nearly inclusive enough of a wide variety of people who represent an untapped pool of creativity, knowledge, expertise, and productivity. More encouraging, though, were the time-dependent data that showed that the situation is improving for women. In what emerged as a major theme throughout the summit, Galvin said the community must not rest on the progress made to date and has much more work to do, both to encourage gender diversity and to better serve other underrepresented groups. This includes leveraging the advances made by women to include other underrepresented groups in minerals, metals, and materials engineering—African Americans, Hispanics and Native Americans—who have not shown the same improvement over the last two decades, as demonstrated in Figures 1-3.
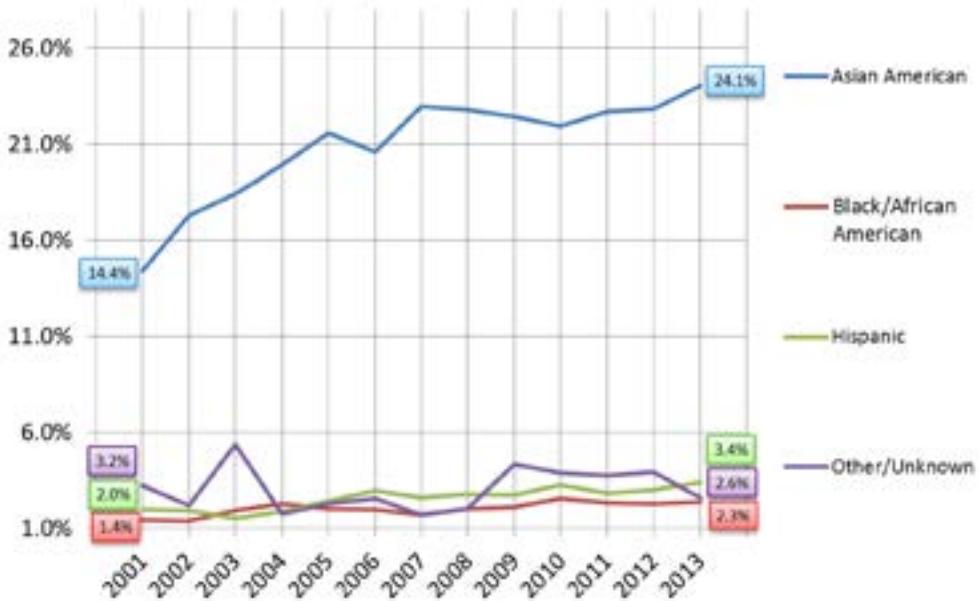
Figure 1. Percentage of total faculty members in materials science and engineering belonging to various demographic groups from 2001–2013. Data from American Society for Engineering Education.
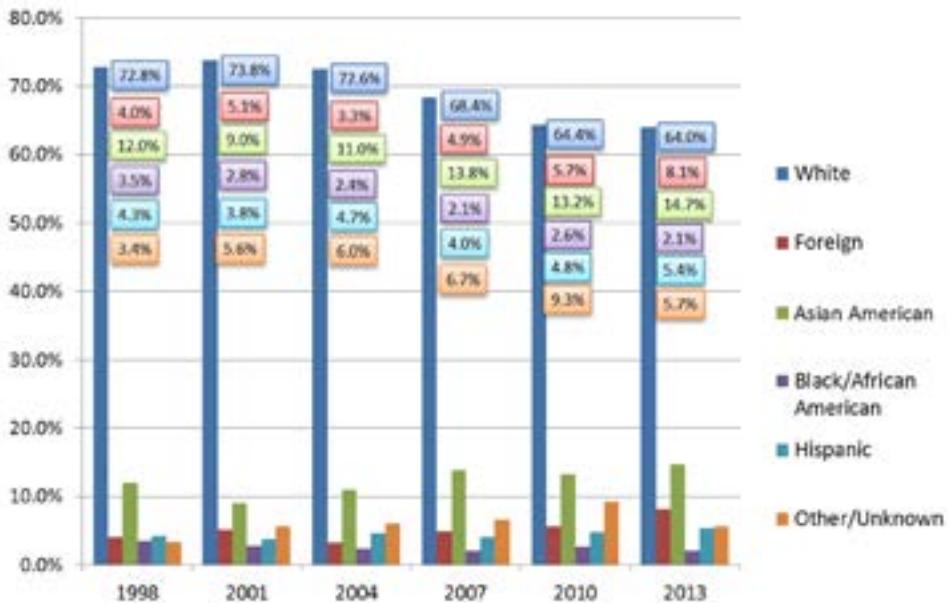
Figure 2. Bachelors' degrees awarded in materials science and engineering to various demographic groups from 1998–2013. Data from American Society for Engineering Education.

One important theme that was elucidated by the plenary presentation, as well as some of the other talks, panel discussions, and working sessions, is that we need better statistics that deal specifically with the minerals, metals, and materials professional community. These specific data are almost unavailable, as compared to data for the broader science and engineering community, or data for other disciplines and professions within the that broader community.

For a number of years now, there has been a strong focus on how to get women, minorities and other underrepresented individuals in the STEM workforce. Progress is evident, as women now account for 25.7 percent of assistant professors in STEM, which is up from 16.5 percent in 2005 (See Figure 4). Nonetheless, Galvin said, the "workforce pipeline" remains a critically important issue that deserves continued attention.

Galvin also emphasized that, once a more diverse workforce is achieved, the STEM community needs to make sure that the workplace remains as welcoming as the pipeline.
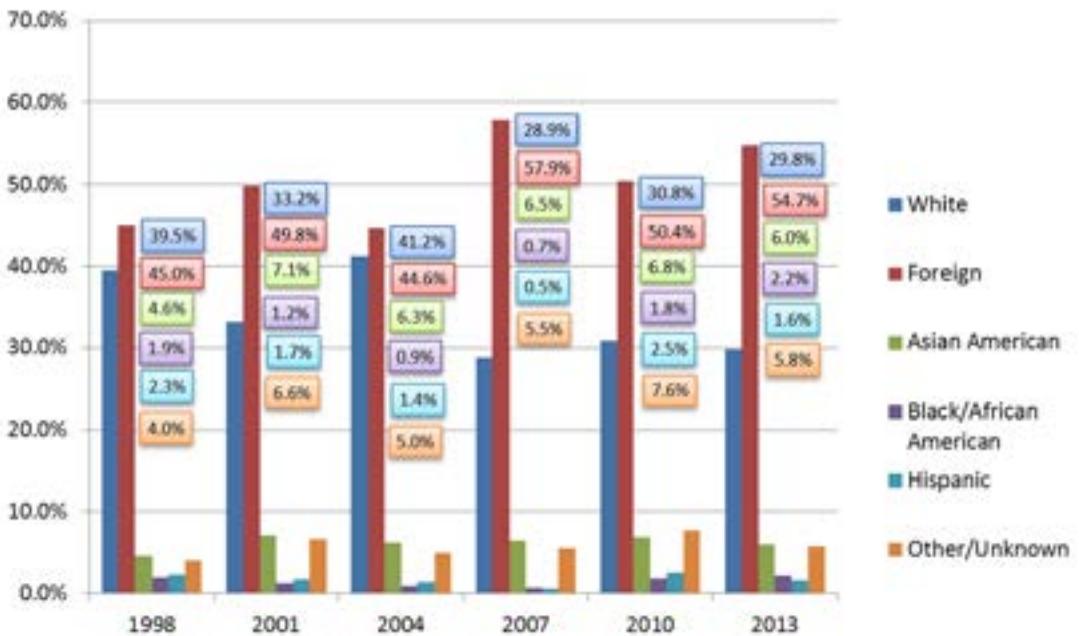
Figure 3. Ph.D.s awarded in materials science and engineering to various demographic groups from 1998–2013. Data from American Society for Engineering Education.
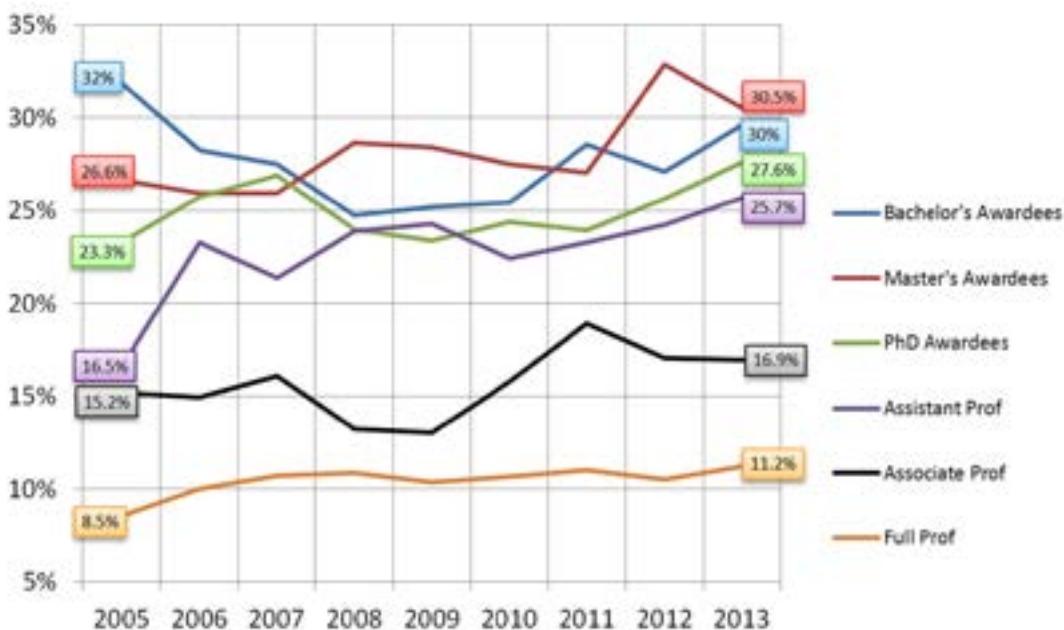
Figure 4. Percentage of women from bachelor's degrees through full professor positions from 2005–2013. Data from American Society for Engineering Education.

About the Presenter

Mary Galvin is the director of the Division of Materials Research at NSF. She earned her Sc.D. in polymers/materials science from the Massachusetts Institute of Technology (MIT) in 1984 and previously held positions as a distinguished member of the technical staff at Bell Laboratories and as a distinguished professor of materials science at the University of Delaware. Prior to joining NSF, she was a member of the Technology Leadership Team at Air Products and a program manager in Basic Energy Sciences at the Department of Energy. Galvin is a member of the American Chemical Society and the Materials Research Society, and is a Fellow of the American Physical Society.

INDUSTRY KEYNOTE: DIVERSITY TODAY: WHAT DOES IT MEAN, AND WHY DOES IT MATTER?

Above: Dawne S. Hickton, Vice Chair, President, and Chief Executive Officer, RTI International Metals, Inc.

Kicking off the three sector-focused keynote presentations was Dawne Hickton. In her leadership position at RTI International Metals, a supplier of titanium and specialty metal products and services, Hickton said she brings a unique perspective on the state of diversity today in U.S. manufacturing. She not only represents a constituency affected by the impact of diversity measures on industrial companies, Hickton said, she is in a position to create and implement diversity efforts and influence their outcomes. More important, she said, it's imperative that she does so.

"As CEO, I am in effect the chief diversity officer," Hickton stated. "I have come to realize that in order to cause change, I must be the one to make it happen."

Hickton began her talk with an analysis of the history of workplace diversity in the United States in general and at RTI in particular. She assessed the impact of affirmative action and Equal Employment Opportunity (EEO) legislation on industrial companies by posing and discussing several weighty questions:

- How did industry first approach affirmative action in the 1960s?
- What attempts have been made to promote diversity in the industrial workplace?
- How has the concept of diversity changed over time?
- What are the forces driving change?

As Hickton noted, affirmative action and EEO (which turns 50 in 2015) were initially aimed at closing the racial divide, ensuring that all job applicants would be treated equally "without regard to their race, creed, color, or national origin." It took many years for the scope of the law to widen to address all of the issues surrounding women's rights, as well as an individual's age, disability, political beliefs, sexual orientation, education, or cultural background. In other words, the full definition of the term diversity—"all the complex ways in which people are different," as Hickton defined it—eventually became a concern in the workplace.

Hickton then turned to the outcomes of several studies conducted by the National Center for Research in Vocational Education to address in concrete terms why diversity should matter to a corporation or an organization. As the researchers pointed out, there are several reasons why it's critical to manage diversity:

- To improve productivity and remain competitive
- To form better work relationships among employees
- To enhance social responsibility
- To address legal concerns

Strategies to manage diversity in the workplace, Hickton added, include implementing several
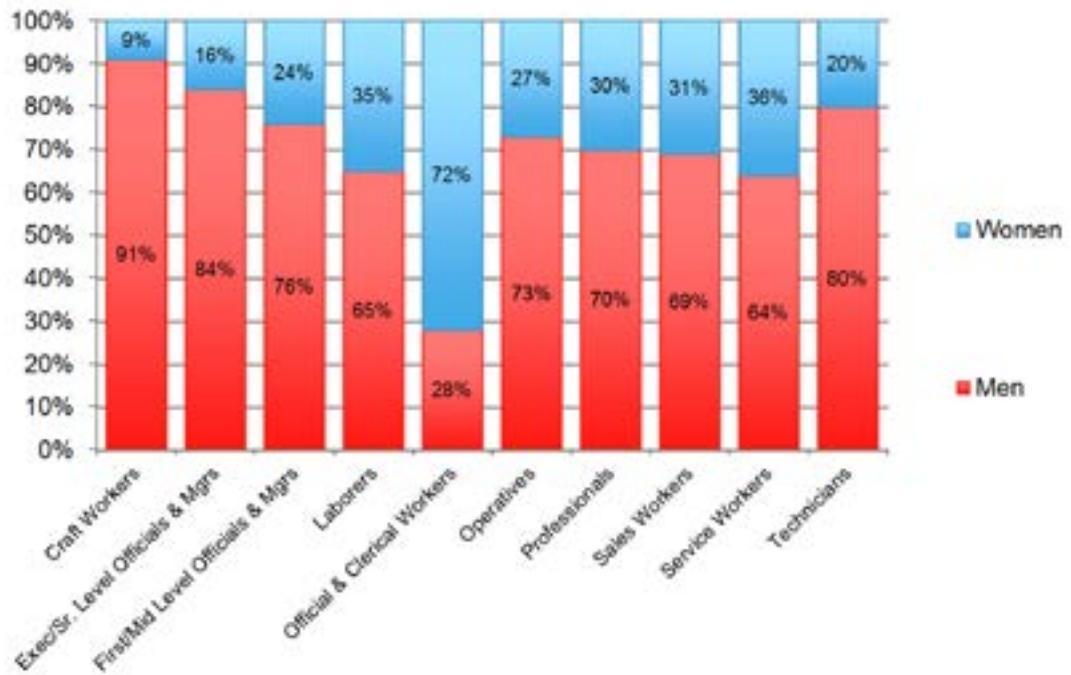
Figure 5. Percentage of men and women in various occupations in U.S. manufacturing sectors. Data from EEOC.gov (2012 statistics).
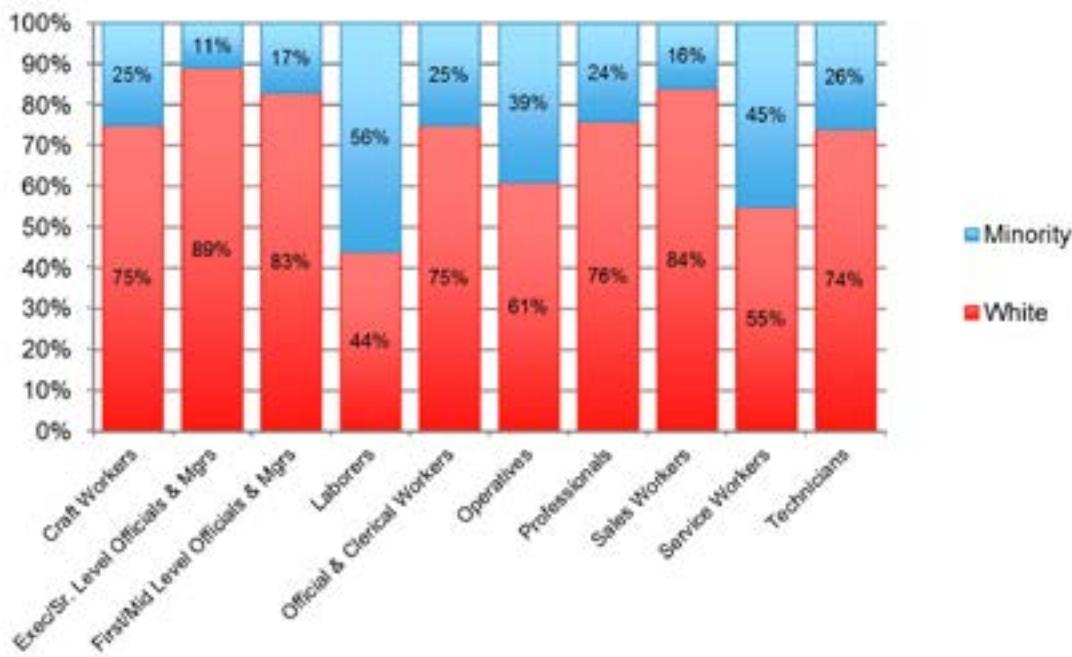
Figure 6. Percentage of white and minority workers in various occupations in U.S. manufacturing sectors. Data from EEOC.gov (2012 statistics).

core programs such as training and education, mentoring, career development, and outreach, as well as establishing appraisal systems that are nondiscriminatory and organizational policies that mandate fairness and equality for all. She noted that organizations must do more than simply acknowledging and achieving diversity in the workplace. They also need to focus on "inclusion"— or "creating a working culture that values the differences between people." Taking such a stance, creating "a state of being valued, respected, and supported," which requires individuals to alter their innate beliefs and behaviors, is difficult but necessary, Hickton said. To illustrate her point, Hickton pointed to the best practices of the top 50 companies of 2014, as listed by Diversity Inc. These firms provide:

- Top-down support for diversity and inclusiveness
- Compensation for executives who achieve diversity goals
- Formal mentoring programs
- A diverse board of directors
- Money to spend with minority- and women-owned businesses and give to nonprofits
- Corporate mission statements that include diversity

Hickton offered some Equal Employment Opportunity Commission (EEOC) data (2012) showing

the employment level disparities between men and women and among minorities in various U.S. manufacturing sectors. Like Galvin's presentation, Hickton's numbers showed room for improvement. For instance, as shown in Figure 5, compared to men, the majority of women occupy office and clerical positions, and labor and service-oriented jobs; very few (9 percent) are "craft workers," "executive/senior level officials and managers" (16 percent), or "first/mid-level officials and managers" (24 percent). The reality for minorities was no brighter. Compared to white American workers, the majority of minorities can be found working as "laborers" (56 percent), "service workers" (45 percent), and "operatives" (39 percent) (see Figure 6).

To provide some context, Hickton next discussed her experience and success promoting diversity at RTI by comparing her firm's achievements to the general EEOC figures. Women at RTI, for instance, fared slightly better than the overall manufacturing sector, Hickton stated, especially in terms of "executive/senior level officials and managers" (27 percent vs. 16 percent) and "sales workers" (67 percent vs. 31 percent). And although minority workers edged out their national peers in the area of service (60 percent vs. 45 percent), few held executive or sales positions.

RTI has implemented diversity initiatives, according to Hickton, who noted that "our workforce is inclusive of multiple cultures, thoughts, ideas, and backgrounds, [which] is reflected in how we operate and enables our global success." The success of such initiatives, she added, is dependent on a number of factors, including measurement protocols, promotions and hiring policies, solid leadership, and a strong talent pipeline.

Hickton ended her talk by circling back to the original question of why diversity matters, emphasizing that diversity is not just a way to define the make-up of a company. It is and can be a powerful driving force for spurring creativity and innovation, business growth, attraction and retention of top talent, increased productivity, and a reduction in litigation.

About the Presenter

Dawne Hickton is vice chair, president, and chief executive officer of RTI International Metals, Inc., a global supplier of advanced titanium products and services in commercial aerospace, defense, propulsion, medical device, and energy markets. She is also an officer and member of the board of directors of the International Titanium Association, a member of the board of governors for the Aerospace Industries Association, and serves on the board of the Pittsburgh branch of the Federal Reserve Bank of Cleveland. Hickton also serves on the advisory council of the University of Pittsburgh Cancer Institute, and the University's board of trustees. She is a graduate of the University of Rochester and received her law degree from the University of Pittsburgh School of Law in 1983.

ACADEMIA KEYNOTE: ATTRACTING AND RETAINING WOMEN IN ENGINEERING AND THE PHYSICAL SCIENCES: THE ACADEMIC EXPERIENCE

Above: Linda M. Abriola, Dean of the School of Engineering at Tufts University.

Similar to Mary Galvin's opening plenary address, Linda Abriola presented data to show that, in the academic sector, though progress has been made over the past three decades toward more diversity, the results are mixed.

In the United States, women have become an increasingly larger percentage of university graduates, far outpacing men. Since the mid-1980s, when women began earning more college degrees than men, the climb has been steady. By 2008, in fact, the number of U.S. bachelor's degrees conferred upon women (in all fields) had reached more than 900,000, nearly one-third more than for men, according to data from the NSF. But women are still greatly underrepresented in engineering. Over the past decade, the share of bachelor's degrees in the field awarded to women has plateaued, reaching 19 percent in 2013. And the story is even more dramatic for underrepresented minorities: American Indians, Hispanics, and African Americans each represented less than 10 percent of all B.S. engineering degrees awarded in 2013, according to the American Society for Engineering Education.

Abriola stated that one of the major hurdles for achieving higher numbers of diverse degree earners is retention. Greater diversity could be achieved if universities managed to keep the students they initially attract. As she pointed out, studies have frequently found that women, underrepresented minorities, first-generation students, and those from low-income backgrounds leave STEM fields at higher rates than their counterparts in other non-STEM disciplines.

Abriola attributed much of Tufts success to several key factors, including having women hold six of its top administrator positions (including Senior Vice President for Finance, Vice Provost for Research, and Vice President for Operations), and serving as dean for four of its eight schools.

Women are slightly better represented at the graduate level though. According to data from the American Society for Engineering Education, the percentage of female engineering Ph.D.s rose to 22 percent in 2013 compared with 17 percent in 2002 (see Figure 7).

On the other hand, the number of females moving on to become engineering faculty members is much less encouraging. Although the percentage of women serving as tenured and tenure-track faculty has doubled since 2001, as of the fall of 2012 they comprised only 14 percent. African American and Hispanic faculty representation during the same period has fared even worse, barely clearing 2.5 percent and 3.5 percent, respectively.

So, if there are some gains being made, why is there concern that they need to occur more rapidly and be more wide-ranging? According to Abriola, the slow ascension of women and underrepresented minorities has an impact on three main areas:
- United States competitiveness–shortages in the scientific and technical labor forces make us a weaker market force
- Quality–innovation traditionally occurs through a diversity of perspectives
- Equity–equal access to all professions should be a basic right to everyone

To get a better sense of the state of diversity and inclusion in academia, Abriola recounted a 2010 National Research Council study in which she joined a committee of peers from 10 different universities to measure "gender differences at critical transitions in the careers" of STEM faculty. They conducted two surveys, focusing on hiring, tenure, and promotion, as well as other career-related information, examining six disciplines: biology, chemistry, civil engineering, electrical engineering, mathematics, and physics. Combined, the studies produced some mixed (and surprising) results, Abriola said.

For instance, the majority of male and female faculty "enjoyed comparable opportunities within the university, and gender does not appear to have been a factor in a number of important career transitions and outcomes." However, women accounted for about 17 percent of applications for both tenure-track and tenured positions. In each discipline, the percentage of applications from women was significantly lower than the percentage of Ph.D.s awarded to women.

Departments have not generally been aggressive in using special strategies to increase the gender diversity of the applicant pool, Abriola said. Nonetheless, the number of women on search
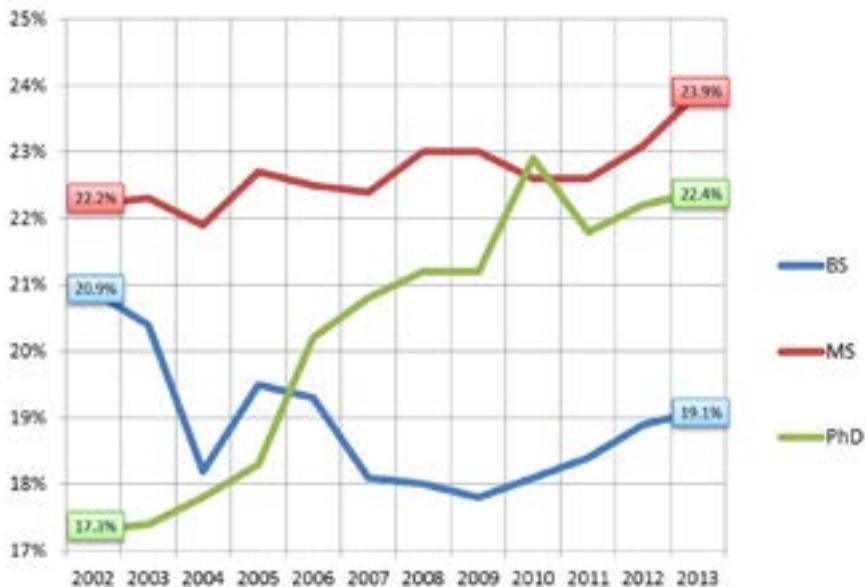
Figure 7. Percentage of female engineering students from 2002-2013. Data from American Society for Engineering Education.

committees and whether women chaired those committees has proven to have a positive impact, she said. According to Abriola, another positive finding is that women were more likely than men to receive tenure when they came up for tenure review. Moreover, no significant gender disparity existed at the stage of promotion to full professor; women were proposed for promotion to full professor at approximately the same rates as they were represented among associate professors.

By way of comparison, Abriola then provided an in-depth look at her own institution, Tufts University. The school has experienced accelerated growth in applications to the School for Engineering in the past 10 years, including a jump in female enrollment, which increased from 26 percent for the class of 2009 to 33 percent for the class of 2018. Perhaps the biggest surprise is that the school graduates as many engineers as it matriculates, leading to a zero attrition rate. Women attending Tufts are performing as well as the men, with 29 percent earning a 3.3 average GPA, compared to 3.24 for males (combined graduates 2001–05). But the same is not the case for other underrepresented minorities, who are not achieving even one-tenth as well as women. In terms of the number of women on staff, Tufts ranked 12th out of 242 institutions in 2013, with almost one-quarter of its faculty female.

Abriola attributed much of Tufts success to several key factors, including having women hold six of its top administrator positions (including Senior Vice President for Finance, Vice Provost for Research, and Vice President for Operations), and serving as dean for four of its eight schools. Specifically in terms of the School of Engineering, the dean's leadership team is more than half (59 percent) female and underrepresented minorities. Also, 23 percent of the engineering tenure-track/tenured faculty are women.

Careful monitoring of the faculty hiring process has also made a difference in the level of diversity at Tufts. The Dean and Associate Dean for Faculty Affairs both take an active role in the search process, overseeing everything from reviewing and approving search committee memberships and the demographics of the candidate pool to meeting all interview candidates and personally making the position offer.

The spirit of inclusion isn't limited to the faculty at Tufts. In 2008, Tufts University created the Center for STEM Diversity to improve recruitment and retention efforts toward underrepresented students in the STEM disciplines. Focused exclusively on STEM diversity, the center's staff advise undergraduate and graduate students, and work with faculty and staff on creating a more inclusive, supportive STEM community. Programs include cohort weekly meetings and workshops, science study groups, and the Bridge to Engineering Success at Tufts, or BEST, which allows the school to identify students with high potential but less college-prep, and successfully transition them to college life and academics.

In conclusion, Abriola said that attracting and retaining women and underrepresented minorities in the academic sector is an achievable goal but "there is no easy solution." By establishing a strong community, developing and adopting certain programs and institutional policies, recruiting well, and investing in people, universities can improve the climate and learning environment for all.

In conclusion, Abriola said that attracting and retaining women and underrepresented minorities in the academic sector is an achievable goal but "there is no easy solution." By establishing a strong community, developing and adopting certain programs and institutional policies, recruiting well, and investing in people, universities can improve the climate and learning environment for all.

About the Presenter

Linda Abriola is Dean of the School of Engineering at Tufts University, where she holds joint appointments in the departments of Civil and Environmental Engineering and Chemical and Biological Engineering. Prior to joining Tufts, she was a faculty member in the Department of Civil and Environmental Engineering at the University of Michigan, where she directed the Environmental and Water Resources Engineering Program, and was named the Horace Williams King Collegiate Professor of Environmental Engineering. Abriola is a Fellow of the American Geophysical Union and a member of both the American Academy of Arts and Sciences and the National Academy of Engineering.

GOVERNMENT KEYNOTE: DIVERSITY IN MATERIALS TECHNOLOGY: A NAVY/GOVERNMENT PERSPECTIVE

Above: Johnnie J. DeLoach, Jr., Head of the Materials Division of the Naval Surface Warfare Center, Carderock Division.

Johnnie DeLoach delivered a very personal keynote presentation, sharing the story of his career growth as well as perspectives from his role at the Naval Surface Warfare Center. He discussed workforce demographics data, comparing mechanical engineers over the previous two fiscal years, as well as the breakdown across the civilian labor force and the Naval Materials Division. Both comparisons found significant room for improvement in terms of both gender and race.

What DeLoach offered was a possible solution: "The goal is not to focus on diversity. The key is consistency." Organizations must strive for a continual and persistent commitment to a number of policies and objectives in several core areas, he said, including:

- Awareness, including training, special emphasis programs, and demographics
- Outreach to maintain relationships with external organizations, and a focus on STEM
- Recruiting and hiring to choose the best-qualified candidates from the widest, most diverse pool, and benchmarking policies against top organizations
- Professional growth to maximize opportunities to realize full potential, and implementing mentoring programs
- Selection/promotion must be open, competitive, and provide upward mobility opportunities
- Accountability

"Change, if it is going to be made and to be lasting, must come from within,"

DeLoach said. "Leaders shouldn't just preach to the choir, they should be the choir."

"Change, if it is going to be made and to be lasting, must come from within," DeLoach stated. "Leaders shouldn't just preach to the choir, they should be the choir."

To underscore such a sentiment, DeLoach ended his talk with the story of the announcement of the Lightweight and Modern Metals Manufacturing Innovation (LM3I) Institute, a new White House initiative that aims to spur innovation, manufacturing and implementation of lightweight and modern metals and strengthen national defense and U.S. manufacturing public-private partnerships. DeLoach, who served on the committee to create LM3I and who met President Barack Obama in person, noted that the makeup of the people in the "blue room" on the day the initiative was announced—a group that consisted of men, women, and people of color —"would have seemed unlikely a generation ago."

Above: Photograph of President Obama with individuals involved with the Lightweight and Modern Metals Manufacturing Innovation Institute and the Digital Manufacturing and Design Innovation Institute (Official White House Photo by Pete Souza).

It was a powerful statement, and one that underscored in a very personal way the theme of the Summit: although there's a lot of work to do to improve diversity in the profession, we've also made important strides, despite what the numbers say.

About the Presenter

Johnnie J. DeLoach, Jr. has more than 30 years of naval engineering service in a broad variety of materials-related engineering and R&D programs. In 2014, he was selected to head the materials division of the Naval Surface Warfare Center, Carderock Division. Prior to his current position, DeLoach served as the head of the Welding, Processing, and Nondestructive Evaluation branch since 2001. DeLoach is the U.S. National Representative on the Metals and Ceramics Technology and Performance Panel of The Technical Cooperation Program. He recently was selected to chair the Naval Sea Systems Command (NAVSEA) Warfare Center Navy Materials Community of Interest, a collaboration intended to enhance synergy, teaming, and expertise in materials and materials-related technologies. In 2013, the Office of Naval Research selected him to manage The Lightweight and Modern Metals Manufacturing Innovation Institute, a U.S. presidential initiative. DeLoach earned his B.S. in materials science and engineering from Brown University and his M.M.S.E. from Johns Hopkins University. He has received a number of awards and commendations from various Navy, Department of Defense, and civilian organizations. In 2012, he was inducted as a Counselor of the American Welding Society for lifetime contributions to the welding industry.

Breakout Sessions: Industry, Academia, and Government

Following the morning's plenary discussion about the state of diversity in the profession and the succeeding keynote addresses, attendees from each of the three sectors—industry, academia, and government—participated during the first day of the summit in interactive breakout workshops to discuss what they heard and how the opinions shared by the speakers resonated with them. Participants from each of the three sectors gathered separately in three different rooms and broke out into small working groups of 5–8 at each table within a given room. They were asked to discuss the challenges and opportunities for achieving diversity in their workplaces within the minerals, metals, and materials (MMM) community. They were presented with several questions, focusing on the state of diversity in the sector as a whole, as well as in their respective workplaces. They were also asked to offer examples of successes and challenges, and to recommend tools to help others. They were instructed to share their ideas and experiences with their table-mates, and then each group presented its collective opinions with the others in the room.

INDUSTRY

Above: Attendees participate in the Industry breakout session.

HIGHLIGHTS

» A wide spectrum of progress in diversity has occurred in the MMM industrial sectors represented at the summit (but nevertheless there is much more to do).

» There is a lack of data for diversity and inclusion in the industrial sector in general, as compared to academia.

» There are a number of success stories, lessons learned, and best practices from the MMM industrial sector (and many that were shared in this breakout session).

» It is important to include diversity and inclusion in the strategic plans of companies in the MMM professions, as well as in all industries.

» Diversity should be considered as a performance metric.

» The value of Employee Resource Groups cannot be understated. "Employee Resource Groups" in this context are groups in which different employees from different areas of a company have been pulled together, in order to get their responses on a variety of topics.

EXTENDED SUMMARY OF DISCUSSION

Question (Q): What did you hear in this morning's presentations and panel discussions that surprised you?

Most participants affiliated with the MMM professions from the industry sector agreed that the amount of data presented by the non-industry speakers, and the trends and rather dismal statistics that emerged from some of these presentations, was eye-opening. The availability of diversity data in other sectors, particularly academia, as compared to the lack of quantitative information about diversity from their industrial peers in the profession, resulted in a common discussion along the lines of, "we wanted similar data from our sector."

The group was encouraged by Tufts University's success in achieving a zero attrition rate among engineers (compared to, as one participant put it, "weeding out the survivors"), and they suggested Tufts's good fortune was also likely related to a small population and, as the speaker divulged, a related hands-on (and perhaps, "hand-holding") mentoring program. Some in the industrial breakout session were also surprised to learn of the relatively equal distribution of women in research and teaching positions in general at universities, as this information is of value in accommodating the pipeline for the research workforce in the MMM industrial sector. "People can succeed if given the opportunity," was one comment.

It is important to include diversity and inclusion in the strategic plans of companies in the MMM professions, as well as in all industries.

The outcomes of the National Academy of Sciences double-blind test (mentioned in multiple presentations at the summit) were also surprising to many in the industry group. In this double-blind test, both men and women picked male candidates over female candidates in cases where the resumes they were provided were identical, but only the name was changed to that of a female candidate, rather than the male name.

Another topic that surprised the members of the industrial sector session was how many at the summit agreed that little progress toward improving diversity has been made in the past decade, in all three sectors. Specific comments included, "with all the attention that's been made towards diversity and training and all that, we really haven't seen the needle move very much," and, in relation to how low the bar for success has dropped, "I can't believe that a two percent increase is considered 'significant.'"

A few of the industry participants expressed dismay that, though all three plenary speakers put an

emphasis on the importance of mentoring—a term that was used as a universal label for several forms of coaching—it would have been beneficial for someone to supply a more exact definition of the term "mentoring."

Q: What did you hear in this morning's presentations and panel discussions that resonated most with you?
One of the themes that most resonated with the industry participants within the MMM professions was the fact that there was a significant and obvious cultural difference between industry and the other two sectors. As one participant noted, "some of us have worked with academic collaborations and there is a little bit of a disconnect between their world and ours." Several agreed and thought that it was refreshing to see an increase in operational ideas that come from industry being adopted in the other sectors. For instance, the practice amongst a number of companies that each open position require a diverse candidate pool, and that the candidate pool itself needs approval, is beginning to be adopted in some non-industrial organizations as well. Keynote speaker Johnnie DeLoach's succinct challenge to each individual to simply "make the change" was one of the most-quoted comments of the working session. Most people in the industrial focus group said that they agreed with and really liked the statement, especially the idea that, as one participant noted, "You have to be proactive and go out there and change what you want changed, rather than wait for a policy to come into place to make it for you."
Another statement that resonated with most of the groups was "if it doesn't come from the top"—that is, if the idea of making the workplace more diverse and inclusive doesn't start with leadership—"it's not going to happen." Taken in combination with DeLoach's challenge to each individual, at any level of an organization, it becomes apparent that the optimum approach is a combination of top-down and bottom-up, with the two strategies not just meeting in the middle, but crossing over, leveraging, and complementing one another.

Another theme that resonated with the industry members within the MMM community is the need "to grab people early," to inspire young men and women—including from the whole K-12 spectrum and not just middle school and older—to become interested in science and engineering. This must not be left to the educational system alone to make progress, though; industry must find innovative ways, beyond what has been tried previously, to reach out to minority children as well.

Work-life balance was another topic engaged by the industry group. As one participant noted, "it seems to be a problem that everyone has." More specifically, the U.S. culture of the ideal good worker, one who works all the time and is always on call, often conflicts with the notion of being a good family person or having a healthy social life. Several examples were provided of how this work-life balance issue is being addressed within individual workplaces. The approaches varied and likely need to be tailored to the specific workplace, but the bottom line is that to enable a more inclusive workforce, this problem needs to be brought to the forefront and discussed openly, and solutions can then be brainstormed and mapped out.

It was also pointed out that there was a culture shift from sector to sector about how to address work-life balance. One participant noted that the government response, at least from the perspective provided in DeLoach's presentation, seemed a little more open to making it possible for people to find such a balance. In contrast, one participant noted that industry tends to have

more of a 'we want you to have a work-life balance but we also want you here as often as you can be" approach.

Several of the companies represented are using employee resource groups to handle important subjects such as diversity. The idea is to pull different employees together, from different areas of the company, and get their responses on a variety of topics. Some companies even encourage such groups to have more of a business focus, or, as one participant put it, "to really see themselves as supportive of business." Resource groups provide employees with the ability to share ideas with their peers and learn from each other about solutions.

Q: What ways have you seen the culture at your organization (or others) change with respect to diversity while you have been there?

Several participants offered examples of how establishing a top-down approach to ensure diversity culture change has made an impact in their organization. One person now serves as Director of Diversity and Inclusion at her company, and she indicated that although their organization is still in the process of "struggling to figure out" what diversity means and how to demonstrate it is making a difference, simply creating the role has been an important step. "If we didn't do it we would probably still only be saying the words," she said, and not putting them into action. Someone else observed that this is perhaps a living example of DeLoach's morning charge to effect change by just doing it.

Several of the companies represented are using employee resource groups to handle important subjects such as diversity. The idea is to pull different employees together, from different areas of the company, and get their responses on a variety of topics. Some companies even encourage such groups to have more of a business focus, or, as one participant put it, "to really see themselves as supportive of business." Resource groups provide employees with the ability to share ideas with their peers and learn from each other about solutions. In one example, an employee resource group helped shift the focus beyond standard diversity issues and toward more inclusion across the company. It was a move that started with leadership, with a CEO who insisted on including everybody and making sure that the employees were working together and not funneling things into their own departments.

One participant stated there is a big difference between diversity and inclusion: "To me diversity

is the pieces around the mix. The inclusion is getting the various mixes to work together." Similar comments were echoed by others in the industry breakout session.

Another strategy that surfaced was that fostering a successful transition to a more diverse culture requires a few key factors, including (1) education, (2) support (both top-down and bottom-up), and (3) strong communication. It was noted that "The challenge is getting people comfortable with the idea." Nominating a diversity director/manager or some other employee responsible for infusing the culture with inclusion-oriented resources can be very helpful with all three aspects, and likewise, the business case for diversity has to be articulated.

An important factor, most agreed, is also patience. Although each individual needs to be proactive and work immediately toward progress, making diversity and inclusion part of a business strategy, though achievable and impactful, does not happen overnight. People leading this movement must not get dismayed when things are not moving as fast as they would like, but instead take it as a positive challenge and know that this will be a long-term project.

Above: Joy Hines Forsmark, Ford Motor Company, speaks during the industry breakout session.

VIEW FROM THE INDUSTRIAL WORKPLACE TODAY

Q: What workplace culture elements are important to understanding, practicing, and measuring diversity and inclusion in your work environment?

Some of the MMM professionals from industry mentioned that a dichotomy exists across the different business areas within their companies. For instance, the production environments

rely on key performance indicators (KPIs), which are necessary for measuring success and improving awareness. But, to date, few companies have applied KPIs to diversity. One company representative said they have initiated some KPIs, along with a five-year plan, focused on increasing the percentage of females hired and the number of females in upper-level management, as well as addressing recruitment strategies with universities.

The importance of understanding whether firms are more process-oriented versus outcomes-oriented was also discussed, with recognition that companies often take an outcomes-oriented, one-size-fits all approach. In other words, if a company wants to stress inclusion it can, along with a five-year plan, but it must consider evaluating those processes with respect to outcomes.

Before one can understand or measure diversity, one needs to define diversity—and not just at the local level but also at the regional, national, and international levels, and amongst people with different jobs, different backgrounds, and different educational levels. Within an organization, conducting employee surveys was highlighted as a particularly effective way to define diversity. How much companies can ask on a survey, how much people are willing to divulge, and the fact that surveys should be voluntary are all key issues for considering surveys. Employee opinion surveys can bolster business strategies and be used as planning tools for human resources departments and others.

As the concept of diversity takes shape within a company, the next step is to figure out which groups need to be addressed or influenced (i.e., management, senior managers, etc.), and then be willing to use diversity/inclusion criteria in the performance reviews of people.

Succession planning is another strategy to encourage a diverse workplace. It was noted that not only is it important to have a diverse succession pool, but it is also critical to prepare the people in the succession pool (many of whom might be underrepresented minorities) for the next level, in order to avoid setting someone up to fail.

Having an open-door policy was an element of culture that industry participants in the MMM community at the summit considered to be important for fostering diversity and inclusion in their workplaces. In a related fashion, one member of the group discussed how open-mindedness in having the willingness to let people move to other organizations within the company (or even beyond the company) can have a positive effect on the culture: "Just because you have a really exceptional, diverse person, if the manager is being evaluated on diversity, they may not want to let that person go and that can hinder a person's career path," the participant said. The result can be a negative culture within an organization.

Q: What are some key workplace challenges that you face today?

One of the biggest workplace challenges facing individals in MMM-related industries, and that was acknowledged in the industry working session, is that many firms periodically experience workforce reductions, for instance, due to the cyclical nature of their business. Cyclical workforce reductions are a business issue that affects everyone, both customers and suppliers alike, forcing many "to take drastic measures." And in such an environment it is difficult to create a diverse

and inclusive workforce. One example that was pointed out that makes the problem worse within the MMM community is that women may be going into engineering, but they are not necessarily going into industrial or mining engineering.

As a possible solution to the challenge of the shortage of quality minority candidates, companies should consider investing in STEM programs and trying to make some manufacturing positions, in mining and elsewhere, more attractive to women and others. If they have a better understanding of what those positions are about, women and other underrepresented minorities will be more likely to want to procure and hold such jobs. Another common, related, issue is retention of outstanding people who, for any number of reasons, are leaving their jobs in the MMM professions. Several participants suggested possible solutions to keeping these valuable individuals attracted and in place, including strategies such as job-sharing and flexible work schedules. But, as one attendee put it, successfully solving this challenge "depends on the culture of the organization."

Q: What tools have your organization implemented to improve or assure diversity and inclusion?

When it came to discussing the tools that their organizations have successfully utilized to improve or assure diversity and inclusion in the workplace, the industry participants offered a number of examples that were related to their previous, broader, discussions. For example, some participants provided specific examples of employee resource groups and the advantage they offer for coworkers to share with their peers and learn from each other about solutions. It was also suggested that executive sponsorship of the employee resource groups should be encouraged, in order to ensure success.

The importance of getting executives and leaders exposed early in the discussion about diversity, to get buy-in from the top to ensure the ideas cascade down to the rest of the organization, was pointed out within the context of specific companies represented at the summit. It was stated that such an approach reinforces the message, especially if it involves a change in mindset or policy. It was pointed out that such high-level buy-in early on can normalize this type of thinking, analogous to how a miner's safety journal can help change the mindset toward safety in mining organizations. The goal is to make diversity "part of what we do."

Being inclusive in identifying candidates for succession planning, as mentioned earlier, is one strategy that is being implemented to improve diversity, but mentoring these candidates is necessary to ensure their success. The need for effective mentors was a recurring theme during this industry working session, and throughout the entire diversity summit.

THE FUTURE: VISION AND RECOMMENDATIONS

Q: What would you like to see in your work environment? List the important elements of your vision.

When it came to predicting the future of diversity in the workplace, there were plenty of

visionaries in the industry working session, with many good suggestions for achieving their dreams for the future. Full incorporation of diversity, creating a formalized program for inclusion in the culture, was alluded to. "It must become the way we operate, kind of like 'second nature,'" one participant said. By formally developing a plan to include a more diverse candidate pool, she added, a company does more than just hire the right people—"you actually are creating a culture where they can thrive and be successful as well."

A popular idea was that using blind studies as tools to incorporate "a natural" state of diversity, as opposed to a "manufactured" one, would be a helpful strategy. It's hard to deny or discount the hard facts from such surveys, and such can open people's eyes to the problem, and thus more quickly stimulate solution pathways.

Another suggestion for actionable short-term changes was centered about reconsidering traditional modes of operation in industry in favor of different and alternative ways, such as introducing flexible hours and a flexible work environment that allows working from home. "We need to change our corporate policies to match the desires of the workforce," one participant offered, "instead of forcing your workforce to change because of our corporate policies."

The concept of establishing a full and diverse pipeline was offered by several groups as a feasible short-term goal that will yield long-term results. Specific suggestions which included targeting young students with an interest in engineering included: industry personnel visiting elementary schools, inviting school children to visit a company, sponsoring a baseball team or scouting troop, or establishing a mentoring program. The key is to be proactive and not reactionary. Such programs can foster a corporate culture that views differences as a positive influence.

Other suggestions by participants from industry, toward their vision for the future, included:

- "Breeding a culture of communication"
- "Having open conversations about diversity and inclusion"
- "Training leaders to have different skills or styles and to value differences in others"
- "Encouraging trust between employees and management"
- "Seeking support for new initiatives and engagement"

Each of these visionary pathways, and combinations thereof, can be positive forces for change.

Another suggestion for actionable short-term changes was centered about reconsidering traditional modes of operation in industry in favor of different and alternative ways, such as introducing flexible hours and a flexible work environment that allows working from home. "We need to change our corporate policies to match the desires of the workforce," one participant offered, "instead of forcing your workforce to change because of our corporate policies."

The need for tools for measuring change was also included in the industrial vision for future pathways. This includes developing tools that measure the success that having a more diverse culture has on, say, product innovation. For instance, traditional KPIs may not be enough for a company to gauge market growth as a result of inclusion initiatives.

The question of whether any of these visions for change within the MMM industrial community could be achievable in a reasonable time frame was met with a note of cautious optimism, as well as a call for steadfastness, as reflected, for instance, in the statement: "With the mining industry, this is a huge cultural change for us, so it's not going to happen overnight."

Q: What recommendations do you have to improve diversity and inclusion in your organization or sector?

As a natural follow-up to the discussion of a future vision for industry, the participants in each of the groups made recommendations for what they would offer as solutions to improve diversity and inclusion in either their specific organization or sector.

One of the groups discussed the need "to bring our knowledge back to the industry"—for instance by discussing many of the industry developments from this working session with leaders of the various professional societies related to the minerals, metals, and materials professions. Several people suggested sessions on diversity and inclusion at their societies' annual meetings, including discussions of workplace improvement opportunities. Topics for such sessions could include the addition of flex time to accommodate the needs of working families, for instance, along with other tactics that create a more empathetic management style and foster greater understanding of everyone's situation.

In bringing back these ideas and recommendations to their specific companies, one participant pointed out that "I think everyone needs to be more empathetic to everyone's situation. It's not just the managers, it's all the other employees, too."

Some additional recommendations emerged regarding the need to interest children and others in engineering as early as possible, for instance by having representatives of their specific companies visit schools and sponsor sports teams, take-kids-to-work days, etc. Someone then suggested taking things a step further: "Maybe we should not just be bringing our own kids to work but bring anybody we know to work, anyone who would be interested in sharing knowledge, getting used to the idea of what an engineer is."

Just as important as involving students at a younger age in specific areas of expertise, industry needs to involve young women early, too. Specifically, it's important to educate young women on the versatility in the engineering world and to encourage them to get involved in the materials community. "The important term is 'versatility,'" one attendee said, because young women will "see a bright future for themselves, with the opportunity to grow into various areas of materials operation. And therefore we can involve the younger ones earlier in their stages of life, introduce them to what materials are all about."

Equally important is the need for developing the craft and more technical roles in the industry, such as supporting trade schools for apprenticeships, because "you can't ignore the hourly side of the business." It was mentioned that the discussions have extensively covered the management side of the business, but it shouldn't go unmentioned that at the more manual-labor end of the workforce there can also be "a huge difference" between the income levels of white workers and the underrepresented minorities. Next, the idea was offered of having minority organizations "market candidates towards us for community engagement," instead of the other way around. Another way to accomplish that is to create diversity-focused internships within industry so that high schools and colleges can, as one person put it, "deliver the candidates to us."

> *"Maybe we should not just be bringing our own kids to work but bring anybody we know to work, anyone who would be interested in sharing knowledge, getting used to the idea of what an engineer is."*

Other recommendations included changing the traditional nature of internal job postings for upper management-level positions. Such listings tend to be very focused, eliminating people who could do the job if the qualifications were relaxed a bit. For instance, minority and female candidates who may not be able "to check every single box" in a job posting but might have other, similar experiences and qualifications, can get overlooked. "So, to bring more people into leadership positions, a recommendation would be to think outside the box a little bit, expand out the profile or qualifications for internal job postings, to be more inclusive."

Simply broadening people's horizons was another suggestion, encouraging everyone not to stay exclusively in their own little group within their specific company, but to get out, walk around, meet people from other departments and other floors, to sit down and eat lunch at the cafeteria.

Q: What are the most important first steps toward the vision?

After being asked to act as visionaries for industry and to imagine what things could be like in their particular companies and sectors, participants were requested more specifically to provide

some key first steps that could be implemented, in their specific departments and amongst their co-workers.

Said one group member: "Get buy-in at the top. That's the first step. Nothing else can happen until we get buy-in from the top." Many others agreed. Specific next steps, though, varied amongst the different small working groups within this session. Someone suggested getting a mandate from the board of directors "to force the CEO to do it," while a less prescriptive suggestion involved finding new ways to incentivize diversity measures, for example by developing methodologies that provide direct ties between inclusion and profitability.

An additional simple and immediate first step that was offered was another mandate, of sorts: for everyone to go right back to the office after the summit, identify someone who could use assistance or wants it, and offer your services as a mentor. It's important to make sure there are role models in place for younger engineers to emulate and to make sure they feel like they can step into those roles.

Concerning advocating for diversity within one's individual workplace, one participant said: "Use the power of speaking up…You have more power and control than you think you do sometimes. And if we speak up, at any level, we can move things forward." Along similar lines, another member reiterated the necessity to define the vision for the company first, and then to communicate it clearly and at every level. "Just like deciding that your company is going to be the preferred supplier to your mining customers," he said, "you just decide to be the leader for inclusion…Just put it out there, and say, 'this is where we are going to go."

Finally, one member reminded the group, "as we heard today from the panelists, breaking ground and changing the culture is important, but so is implementing the policies to support it. We need both."

FINAL COMMENTS

Q: Is there something critically important that someone would like to say that hasn't been covered here today? How has this session supported or challenged your capacity for understanding diversity and inclusion in the work environment?

During the wrap-up session, participants in the industrial session were encouraged to comment on any topics that were not previously discussed or needed further clarification.

The notion of defining and separating the terms "diversity" and "inclusion" came up almost immediately, and quickly lead to a suggestion to drop "diversity" from the dialogue altogether. It was suggested that diversity was a means to an end (inclusion), or a pathway to inclusion. Diversity was also referred to as an action item, while inclusion was labeled an outcome.

Another point that garnered consensus was the need to immediately implement many of the ideas generated at the summit—as in, as soon as everyone gets back to the office, "if not sooner!" Following that line of thinking, participants revisited the questions of what are the key takeaways, and what can the participants take back and share with others, to move things forward?

Suggestions for such near-term action directly upon returning from the summit included:

- Begin development of new benchmarks, or measurements of progress.

- Transform the work developed during the summit into KPIs (key performance indicators), as precursors to the outcomes of a more inclusive profession.

- Create a scorecard on the TMS web site, so everyone can measure their progress over the next 12 months or so.

- Establish benchmarks, based on what the most successful companies do in each sector, with respect to diversity.

- Implement something like the Rooney Rule (established by the National Football League's Dan Rooney to ensure that minorities were considered for high-level coaching positions), for hiring, requiring at least one candidate from an underrepresented population.

- Focus on the pipeline by doing more to promote it with children beyond STEM education—make it fun, get the media involved, especially social media. Take the first steps toward this now—don't wait.

- Encourage the leadership of companies to become more active in diversity, by brainstorming, recommending, and establishing some concrete measures specific to your workplace that will get CEOs and others to start thinking more towards diversity.

ACADEMIA

Natalie Larson, a graduate student at the University of California, Santa Barbara, takes part in the academia breakout session.

HIGHLIGHTS

» Top-down change is slow and difficult at universities—so the challenge of how to engage from the bottom up must be addressed. More specifically, policies and guidance cannot just be set by top level leaders at universities, but a culture (and specific programs) must be developed in which students, faculty, and university staff at the grass roots all embrace diversity and inclusion from the bottom up.

» Work-life balance and dual career issues are particularly challenging to women faculty members.

» Opportunities to share best practices should be sought after and implemented

» The NSF ADVANCE program ("Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers") has created an impressive array of resources that could, and should, be taken advantage of by minerals, metals and materials departments (as well as all departments) at universities.

» "Bridge programs" show great promise for underrepresented minorities (URMs). For example, the American Physical Society Bridge Program (APS-BP) is an effort to increase the number of physics Ph.D.s awarded to URMs by creating sustainable transition (bridge) programs and a national network of doctoral-granting institutions that provide substantial

mentoring for students to successfully complete Ph.D. programs.

» Somehow we have to inspire and encourage those who are less committed to diversity and inclusion. Although there are large numbers of personnel at universities who do embrace diversity and inclusion, it is important to enlighten those who, for a variety of reasons, particularly need more education and cultural shift in these areas.

EXTENDED SUMMARY OF DISCUSSION

Q: What did you hear in this morning's presentations and panel discussions that surprised you?

Participants acknowledged the lack of good, quantitative information on the numbers of women exiting the minerals, metals, and materials professions, including in academia. The participants observed some conflicting data. One study demonstrated that the move from assistant to full professor is the point at which many women leave their positions. Another study found that the move from assistant to full professor was not more difficult for women, but that they experienced lower compensation as full professors than their male colleagues. The question was raised whether the compensation disparity might be related to the longer tenure of male professors. The success of Tufts University in achieving a near equal distribution of women in research and teaching positions across all ranks was noted as a successful case study, and several participants suggested that Tufts's progress and process become best practices that others may emulate.

Somehow we have to inspire and encourage those who are less committed to diversity and inclusion.

There was both surprise and dismay at the minimal change in the percentage of African-Americans in the minerals, metals, and materials fields, across all the categories. Many of the academic participants commented that the reported 2 percent increase in representation in the last decade was very discouraging.

Most of the academics were also shocked at the double-blind study revealing that both men and women judge women more harshly in interview sessions. In parallel, another study reflected the double standard that categorized male candidates with children as "hard-working" and female candidates with children as "students."

Several of the academic participants expressed interest and concern that female candidates are not experiencing as much accommodation for their partners as their male colleagues when they are interviewing for positions. When this issue was spotlighted in the panel discussion, the response was that the tendency appears to be toward blaming the interviewee for the problem, rather than focusing on how the university might create an opportunity.

Areas of interest the academic participants thought were not highlighted enough in the morning presentations included:

- Basic traits / skills for leadership
- Why don't we have "best practices" for mentoring
- How to recruit diverse student body from K–12
- Advancement to leadership pathways

Q: What did you hear in this morning's presentations and panel discussions that resonated most with you?

The impact that CEOs in private industry are having in setting the agenda and the goals for diversity in the minerals, metals, and materials workplaces impressed the academic group, and they particularly applauded the wisdom of incorporating diversity goals in corporate strategic plans. The value of role modeling among teachers and professors that was noted by all three of the plenary speakers also resonated strongly with the academics, and they voiced the importance of management training programs to develop mentoring skills in order to provide encouragement and support for underrepresented members of the faculty.

Top-down change is slow and difficult at universities—so the challenge of how to engage from the bottom up must be addressed. More specifically, policies and guidance cannot just be set by top-level leaders at universities, but a culture (and specific programs) must be developed in which students, faculty, and university staff at the grass roots all embrace diversity and inclusion from the bottom up.

It was agreed that these pathways require an intentional change in culture, which was strongly welcomed by the summit attendees from academia. At the same time, it was recognized that what may seem individually to be incremental actions can contribute to making large impacts; such actions include sharing personal stories of career success, supporting failures when they provide a valuable learning experience, and becoming more self-aware of personal bias. In addition, the academic participants reinforced one speaker's point that leaders need to become the "choir" singing for diversity, rather than send the choir (those who already believe) to summits and conferences such as this one. The fact that 78 percent of women in academic roles identify balancing work and family as their greatest challenge was highlighted during these discussion, as was the continuing challenge of salary inequities based on gender.

The fact that African Americans receive only 2 percent of Ph.D.s in engineering was startling to this group, as was the fact that this percentage has essentially not changed in 30 years! On a more hopeful note though, the academic participants projected that the next generation of leaders are already more inclusive and less biased in their acceptance and expectations for those who have been historically under-represented in academic careers and leadership positions.

Q: What ways have you seen the culture at your organization (or others) change with respect to diversity while you have been there?

The academic participants related many positive trends in leadership and frontline activities at their respective institutions, including:

- Deliberate conversations about inclusion at their universities are increasing and ongoing.
- Recruitment and interview pools are reflecting an increased focus on diversity.
- The impact of the NSF ADVANCE program is becoming visible at many universities.
- More female professors are being hired in the materials sciences discipline, including. examples of a change from one female professor to ten in the last ten years in one university; a change from ten female professors to 70 in another university.
- More rigorous standardization of interview processes that emphasize diversity is occurring
- More racial minorities are rising into administrative roles.
- The Family Medical Leave Act coverage has extended to same-gender families.
- At department meetings, there is more awareness of unconscious biases in jokes and storytelling.
- Some departments are shying away from early morning meetings, due to a realization that many professors have to get their children to school in the morning.
- Graduate students are forming affiliation-based support groups at the grassroots level.
- Professional societies are spotlighting diversity
- Some important policies and practices that would support a more positive work environment for faculty that are female and/or from under-represented minorities are still lacking, though, such as solutions to the "two-body" problem by creating opportunities for both partners/ spouses during recruitment.

VIEW FROM THE ACADEMIC WORKPLACE TODAY

Q: What workplace culture elements are important to understanding, practicing, and measuring diversity and inclusion in your work environment?

Following the discussion of some of the encouraging and positive activities happening in individual universities, the academic participants convened to identify desirable best practices for all universities with respect to making inclusion a stronger component of the academic culture and life.

Toward developing a more inclusive culture, some actionable steps forward were identified:

- Believe and articulate the value of inclusion in the workplace—different voices provide better solutions
- Take the long view and take risks that challenge our own individual biases
- Establish direct accountabilities for recruitment, retention, and advancement
- Conduct exit interviews with frank questions about diversity and inclusion issues
- Reward and acknowledge actions that demonstrate inclusion values
- Formalize recruiting processes to provide a roadmap toward inclusion
- Facilitate comparisons between the candidate pool and the national population
- Provide training and encourage an environment for instructional conversations
- Change meeting times and promote leave policies that respect family obligations
- Engage professors and academic leaders in mentoring activities that promote inclusion

Q: What are some key workplace challenges you face today?

One general challenge is that an attitude against diversity still exists with some people (but a hopefully shrinking population) within the academic community. Professors who are female or under-represented minorities, and students (both international and domestic) from underrepresented groups are still, in certain situations, passed over for various opportunities.

The present availability of diverse candidates for faculty positions is also often limited, particularly in the MMM disciplines, and universities are thus put in a position of intensely competing against one another. A larger number of diverse candidates would thus result in a great number of diverse faculty hires, and more scholarship funding for diverse students could help to shift this imbalance.

Another common challenge is for dual-professor families to find faculty positions at the same university. Often, one applicant is viewed as "leading" and the other one is "trailing," and both are not accommodated.

Also, the turnover rate in the tenure positions is very slow; additionally, universities are very slow in making hiring decisions. This reduces the number of faculty openings and the opportunity to choose between offers. As a result, the rate at which improvements in diversity are achieved can be very slow.

Some other specific challenges that were cited include:

- The need for more restrooms for females in some minerals, metals, and materials workplaces
- Forms of sexual harassment at conferences
- Salary inequalities

Q: What tools have your organization implemented to improve or assure diversity and inclusion?

Several effective tools that are improving and/or assuring diversity and inclusion in universities were identified, as follows:

- Including a diversity/inclusion report in the university's annual report
- Setting upfront expectations for incoming faculty and administration about inclusion as a part of the university culture
- Asking about diversity
- Establishing and offering family-friendly policies to all faculty
- Brainstorming and implementing creative new approaches to diversity and multi-cultural sensitivity training

Examples of some specific activities that are providing hope for improving diversity and inclusion include:
- Family-friendly policies that are conveyed to faculty and faculty candidates
- Hiring faculty who are knowledgeable about current data on diversity status and diversity targets for the university
- Options for the partner/spouse of faculty candidates as a hiring package
- Campus daycare/family program
- Graduate student women's engineering network
- Luncheons for students (funding provided by dean's list)
- Strategic plan for positive workplace environment; hiring according to strategic plan
- Information packets for faculty candidates including information candidates may not want to bring up initially (disability child benefits, benefit for same-sex partners)
- Practical training with role-playing and exercises in a safe environment to strengthen inclusion awareness and implementation in the review, interview and selection processes
- ADVANCE tool kits at various universities
- Formal mentoring programs

THE FUTURE: VISION AND RECOMMENDATIONS

Q: What would you like to see in your work environment? List the important elements of your vision.

The academics envisioned a future in which conversations and discussions about diversity issues would occur without fear or anxiety. This could include a structure where a valued person in the administration organizes diversity events for the university that are enthusiastically and financially supported by the faculty.

The end goal is to create a sustainable environment that recognizes and brings forward students from all socio-economic strata into university and industry careers in the minerals, metals, and materials fields based on their interests, talents, and drive. This vision includes an environment in which talented individuals can enjoy career success without bias-based limitations

The academic session participants further delineated near-term ambitions and long-term aspirations for improving diversity and inclusion in the university setting.

The long-term vision in the academic session coalesced around three major areas:

- *Diversity and inclusion should occur at all levels of the university, including faculty and administration, with representation in line with the U.S. population for both race and gender.*

- *A much more robust work-life environment is needed for faculty, researchers, graduate students, etc., with family leave and benefits available to all. Such benefits could include the addition of childcare and elder care, increases in paid vacations, and automatic extension of the tenure clock to accommodate childbirth.*

- *Healthy, engaged, empowered graduate students need to be considered full members of the academic community. Faculty, graduate students, and staff should all engage in intellectual inclusivity and treat each other with respect.*

Near-term goals

In the near term, participants saw the potential for more young scientists / engineers of all genders and ethnicities to view academia as a more desirable career path, in which all students, faculty and staff can engage together with full respect for one another. They also suggested that with small changes and consistent implementation, the university environment could become a more family-friendly workplace that provides similar opportunities for flexible hours and policies across all faculty and staff positions; good opportunities to incorporate current best practices from industry in this area were noted. Faculty training on cultural issues is another important element of such a vision, as well as the shift from a mindset of including a "token" minority on committees to a mindset more geared toward engaging all faculty across the broader spectrum equally.

Long-term aspirations

The long-term vision in the academic session coalesced around three major areas:

- Diversity and inclusion should occur at all levels of the university, including faculty and administration, with representation in line with the U.S. population for both race and gender.

- A much more robust work-life environment is needed for faculty, researchers, graduate students, etc., with family leave and benefits available to all. Such benefits could include the addition of childcare and elder care, increases in paid vacations, and automatic extension of the tenure clock to accommodate childbirth.

- Healthy, engaged, empowered graduate students need to be considered full members of the academic community. Faculty, graduate students, and staff should all engage in intellectual inclusivity and treat each other with respect.

Q: What recommendations do you have to improve diversity and inclusion in your organization or sector?

Some concrete actions that were identified by the academic working group to improve diversity and inclusion in their own organizations, and/or in the MMM sector, included:

- Develop and disseminate videos and specific materials that promote the minerals, metals, and materials professions, and integrate with STEM efforts in the public education system.
- Speak out (on an individual basis) to increase the awareness of the issue of diversity.
- Each individual make personal connections and encourage people from under-represented groups.
- Provide training to search committees to better encourage them to be non-biased
- Champion diversity in STEM in K-12.
- Encourage NSF to mandate "diversity best practices" in order for universities to receive funding.
- Standardize climate surveys and develop a tool(s) so that institutions can self-rank in terms of diversity and inclusion.
- Include accountability for diversity in the performance evaluations of all university leaders.
- Eliminate bias through programs to educate all faculty and staff on diversity and inclusion.
- Present diversity data in annual reports that are distributed both internally and externally.
- Identify and distribute best practices from the NSF ADVANCE programs.
- Extend family planning/accommodation policy universally, including to graduate students
- Institutionalize mentoring programs.
- Engage alumni strongly at your own institution: encourage seeing positive changes toward diversity tied to alumni donations.
- Place tangible value on collaborative team research environments
- Raise awareness of religious diversity

Q: What are the most important first steps toward the vision?

Participants in the academic session shared specific steps that they committed to implement as a result of insights and perspectives gained at the summit:

- Tell my research group about the management results
- Email the people who taught me about diversity challenges to tell them their programs work and have affected me, and ask them for a reading list
- Say no if asked to do things simply because I am a "token" diversity person, or at least explain my position
- Look into the ADVANCE grant at my school
- Assess my own biases (this might include conducting a self-bias test online)
- Suggest that recurring committees assess their bias before revising candidates
- Gather and meet with undergraduate and graduate student groups at the semester start and during the semester to encourage inclusion and encourage a grass-roots critical thinking cohort
- Advocate for defining diversity, and for it to be included as part of a strategic plan
- Set up a seminar series to learn more about cultural backgrounds of students of different nationalities
- Prioritize and make time for outreach activities
- Work with AIME (American Institute of Mining, Metallurgical, and Petroleum Engineers) member society staff to ensure outreach materials are more inclusionary for under-represented minorities
- Incorporate inclusivity into my department's strategic plan
- Recruit a more diverse group of prospective graduate students
- Reassess how to improve the diversity program goals in my organization
- Make sure we are collecting the correct data
- Re-evaluate programs as the problems / issues change
- Assure that all faculty in my department are on the same page with regard to a diversity "strategic plan"
- Increase leadership professional development for promotable faculty
- Promote international involvement in mentoring / advising students
- Review the postdoctoral program to assess inclusion efforts
- Review our organization's programs with historically black and/or Hispanic institutions

FINAL COMMENTS

Q: Is there something critically important that someone would like to say that hasn't been covered here today? How has this session supported or challenged your capacity for understanding diversity and inclusion in the work environment?
Some participants individually filled in the statement: "As a result of today I will…"

- …take a hard look at my own biases

- …thank my professor for sponsoring my attendance and distribute articles to other graduate students
- …present summit content at a monthly seminar for graduate students
- …as new department chair, convene undergraduate and graduate groups to build a cohort for critical thinking and community
- …apply for leadership and management training programs
- …have my faculty and staff take the Harvard implicit Bias Test

GOVERNMENT

Patrice Turchi, Lawrence Livermore National Laboratory, shares his thoughts during the Government breakout session.

HIGHLIGHTS

» Scientists are world travelers with great jobs, and this message is a strong incentive that needs to be marketed in order to attract members of a diverse workforce into government positions in the MMM professions.

» The necessity for more "out of the box" thinking in the government sector was a recurring theme to begin employing more creative approaches when it comes to increasing diversity.

» The need for sharing of best practices was emphasized in the government sector discussions as well (including sharing best practices across industry, academia, and government)

» Giving employees a "bias assessment" with an action plan to mitigate shortcomings could go a long way to improving diversity and inclusion in the government sector.

» Having a "diversity moment" at the beginning of every meeting (analogous to groups that have "safety moments" at the start of meetings) was brought forth as a successful vehicle for a few specific groups within government organizations, and should be considered more broadly.

» Penalizing leaders who miss diversity milestones is an example of another vehicle for promoting diversity and inclusion.

EXTENDED SUMMARY OF DISCUSSION

Q: What did you hear that surprised you?

For the summit participants from the government sector, the outcomes of the double blind study of resumes were most surprising and disappointing. Many of the participants were "shocked and sad" that the study revealed such a disparity in assessment of credentials and appropriate salary, based on the gender of the person whose resume was being reviewed. Secondly, they were dismayed by the lack of impact over the last five years of increased STEM focus on encouraging underrepresented minorities to choose STEM education. Government employees also registered surprise that data for academia and industry were so variable, self-reported, and limited in scope.

Q: What did you hear that resonated most with you?

A theme that the government participants rallied around was keynote speaker Johnnie DeLoach's assertion that the real success for diversity and inclusion will be when everyone realizes that seeking the best and brightest means tapping the diverse pool of all possible candidates. Policy directives to meet diversity metrics are not an end in themselves and will not change culture. DeLoach stated that diversity is a state of mind; this also resonated well with the government attendees.

Since mentoring stood out in the morning talks as an important factor in career mobility, access, and advancement, the government employees picked up on this theme and debated whether, in general, women and underrepresented minorities might be at a disadvantage in accessing mentoring, especially informal mentoring. The need for flexible policies relating to family issues and flexible work hours also stood out from the keynote presentations.

Lastly, the Rooney Rule resonated strongly with the government employees as well. This refers to an NFL rule requiring every team with a coach or general manager opening to interview at least one minority candidate for the position. For the NFL, the rule has resulted in a great expansion of diversity of coaches over the last ten years, with twice the number of minority coaches as in the previous 70 years.

Having a "diversity moment" at the beginning of every meeting (analogous to groups that have "safety moments" at the start of meetings) was brought forth as a successful vehicle for a few specific groups within government organizations, and should be considered more broadly.

Q: What ways have you seen the culture at your organization (or others) change with respect to diversity while you have been there?

Some primary changes in culture identified at the workplace level included more diversity training, more sensitivity to appropriate conversations in the workplace, and more discussions about diversity. In many workplaces, government employees are seeing interviewing and hiring practices that are more inclusive of women and underrepresented minorities. They have seen a shift in the concept of "best candidates" toward inclusion of a wider range of candidates. In addition, within some government organizations they see more acceptance of differences in physical appearances, including tattoos and piercings. Participants from one government organization reported that their new diversity office is making great strides in the visibility and opportunities for underrepresented populations, which was very encouraging.

On the other hand, other workplaces perhaps do not seem to reflect much change in diversity awareness or processes. A few of the government session attendees reported that the policies may be in place, but the implementation of those policies is still sometimes manipulated to minimize their intent.

"Formerly, in our lab, even when we had a diverse pool, we often defined the 'best candidate' as one who 'looks like me," one participant said. "Today, we are really choosing the best candidates from our diverse pool of candidates."

VIEW FROM THE GOVERNMENT WORKPLACE TODAY

Q: What workplace culture elements are important to understanding, practicing, and measuring diversity and inclusion in the government work environment?

Such workplace cultural elements need to go beyond just the demands of management, to fully embracing the concept of diversity and inclusion. This includes being honest (and critical) when evaluating diversity program effectiveness, changing processes to include panels that are committed to diversity, and measuring quantifiable demographics over time.

It was noted that while the NSF measures many statistics, those same statistics are unknown or not visible for the individual workplaces of many government organizations. Additionally, although many government workplaces seem to be taking small steps in the present, such as engaging diverse interns or hiring with more inclusion at entry-level, they are not necessarily providing follow-up career advancement support or longer-term visible opportunities. With limited diversity at higher positions and fewer long-term employees retiring at their eligible age, advancement opportunities for younger employees can be pushed further and further into the future.

Some other key workplace culture elements cited include making everyone feel welcome, and celebrating diversity in the workplace with frequent cultural celebrations. Some summit participants noted that increased remote working opportunities may also open doors for more diverse government candidates.

Q: What are the key government workplace challenges you face today?

Some key government workplace challenges to diversity today—especially in government laboratories, include:

- Remote work site locations that make attracting a diversity of candidates significantly more challenging
- Lack of critical mass—this encompasses hiring diverse candidates despite a homogenous search committee, and the perceived lack of promotion opportunities for diverse candidates who are thinking about career advancement

Salary inequity issues continue to challenge progress for candidates from underrepresented groups—more from the perceived lack of fairness of the entry-level salaries of early-career government candidates who are from underrepresented groups as compared to long-term employees who are apparently doing the same work, but have advanced up the salary ladder simply due to time on the job.

Finally, it was recognized that the existing cultures in some of the government laboratories and other organizations still encompass a significant number of people who are not truly passionate about diversity and inclusion—which leads to implementation without intent. Interestingly though, many summit participants characterized themselves as scientists who do not have implicit bias in the area of diversity, i.e., "scientists who respect scientists." Perhaps this is not surprising, since by definition the people who attend such a summit on diversity and inclusion likely have a desire toward a non-bias mindset.

Q: What tools have your organization implemented to improve or assure diversity and inclusion?

Government laboratories and other institutions that include departments with large numbers of people in the MMM professions have instituted a wide variety of tools that have generated expanded diversity and inclusion successes in recruiting, hiring candidates, and retaining employees. These include:

- Partnering with historically black colleges and universities to introduce students to graduate school opportunities and careers in the minerals, metals, and materials (MMM) professions.
- Partnering with staff for review panels, working with advisory committees, and sponsoring hiring practices reviews by independent organizations have all increased hiring and employee retention, especially for black, Asian, and Native American candidates.
- Diversity training within the organization has also brought improved results
- One government laboratory reportedly increased diversity by 15–20 percent through ensuring that all positions are advertised competitively, with the intent to reach a wide array of candidates
- Also cited were fellowships for diverse candidates and cultural awareness activities.
- Some activities at government laboratories that have been implemented, but are still being evaluated to determine how successful they have been include:

- Encouragement of leadership to increase diversity in hiring
- STEM minority programs

THE FUTURE: VISION AND RECOMMENDATIONS

Q: What would you like to see in the government work environment? List the important elements of your vision.

In the near-term, the government sector attendees would like to see, in a broad sense, a balanced ratio of men to women, as reflected in overall society, with consideration for the work that is delivered, instead of who you are. This should include equal pay, equal opportunity to lead projects, and equal consideration for promotion. The workplace policies that are already in place that allow for maternity leave, telecommuting, and part-time work, should be continued and supported. It was noted that, while many managers verbally support these policies, they rarely take advantage of them, thus setting an example that these practices are not supported. The government session attendees would also like to see "bottom up" promotion evaluations and strategic planning.

In the longer term, this group envisioned a workplace where all employees and managers value diversity and different perspectives, where diversity is no longer an issue. More specifically, this vision would encompass a workplace that represents the demographics of the general population with equal pay for equal work, and great work-life balance. The participants recognized that this is a significant challenge and it requires realism and appropriate tools to attract and keep employees, such as mentoring, and the many other tools and methodologies discussed throughout the summit.

Q: What recommendations do you have to improve diversity and inclusion in the government sector?

Government employees cited some near-term recommendations for improving diversity and inclusion in the government sector, including:

- Change the culture over time by hiring, recognizing, and promoting people who embrace diversity and inclusion
- Enforce behavior that aligns with diversity and inclusion policies
- Engage the younger and more diverse employees in "bottom-up" planning
- Identify and engage exceptional mentors to build the next generation of leaders
- Apply an approach like the Rooney Rule, which was established by the National Football League and requires interviewing minority candidates for senior and leadership positions
- Market the MMM professionals for hire by highlighting the appealing items of government positions: global connections, travel, "cool" projects, good pay, paid education, etc.

Longer-term recommendations include being more rigorous in evaluating hiring practices, including exit interviews, and gathering good data on diversity. Some participants recommended the use of "double blind hiring" to identify and then mitigate biases. Another suggestion is to look at how the opportunity of the "gap year" after high school or after the bachelor's degree might be

used to engage underrepresented populations in the minerals, metals, and materials disciplines, and influence their next steps for education and/or career.

In the national laboratories, I realize that our structure of career advancement often takes scientists away from science and into management. We need at least the option for scientists to progress in their careers while staying close to the science, in order to mentor the younger workforce. We need good mentors who are provided the time to mentor.

Q: What are the most important first steps toward the vision of successful diversity and inclusion in the government sector?

The first steps seen as critical for diversity and inclusion in the government sector extend across a wide landscape. One suggestion focused on TMS (The Minerals, Metals & Materials Society) continuing to take a leadership role in demonstrating diversity in its own volunteer structure, and in capturing and sharing statistics of its members across all sectors. The government sector group was in consensus that powerful statistics will help drive change.

At the organizational level, mentoring was accorded a great deal of weight as a first step toward transforming cultures. Focused recruitment on underrepresented groups was also deemed important. Many liked holding managers accountable for practices set forth in the NFL's "Rooney Rule." Many participants also saw briefing their own supervisors on the data presented and discussed at this summit is an important first step toward change. Others added that holding themselves accountable and using available tools effectively would be their chosen first steps.

FINAL COMMENTS

Q: How has this session supported or challenged your capacity for understanding diversity and inclusion in the work environment?

Participants offered a number of concrete examples of how the government sector session made an impact on their ability to understand the need for diversity in the workplace. Their responses included comments along the lines of:

- In the national laboratories, I realize that our structure of career advancement often takes

scientists away from science and into management. We need at least the option for scientists to progress in their careers while staying close to the science, in order to mentor the younger workforce. We need good mentors who are provided the time to mentor.

- We need good data on what is happening with underrepresented populations who come to work at national laboratories
- This summit has encouraged me to 'think outside the box' and inspired me to take back what I have learned and share it in my workplace. I am now willing to talk about bias and how to achieve perspectives that are broader than my own "white man in management" experience.
- I now believe that 20 percent of us are driving change, 60 percent desire change, and only 20 percent are opposing (loudly) change. The question then becomes, how are we (the 60 percent) going to stick our necks out and support each other in becoming change drivers?

On right: Attendees take part in one of the many breakout sessions offered during the conference.

Breakout Sessions: Early Career, Mid-Career, and Leadership

On day two, summit attendees were given the option of participating in one of a number of simultaneously held sessions offered by TMS. In addition to two different expert-led training sessions, several panel discussion/workshops were held covering a range of topics for career-minded professionals. Attendees were encouraged to participate in the panel-discussion session that aligned most closely with their career stage (early career, mid-career, or leadership).

In these sessions, panelists discussed their experiences and lessons learned as professionals and leaders in the minerals, metals, and materials field. Sharing first-hand knowledge, panelists covered their major diversity and inclusion challenges, and offered advice for those facing similar issues.

A professionally facilitated workshop session followed each of the four panel discussions (outlined below) to utilize the power of the group to identify challenges, strategies, resources, and recommendations for the future and to ensure more opportunities for professionals at different stages of their careers.

Early-Career Issues: Panelists
- **Andrea Hodge**, Associate Professor and the Philip and Cayley MacDonald Early Career Chair in the Aerospace and Mechanical Engineering Department, University of Southern California
- **Kathryn Kosloski**, Mining Engineer for Luck Companies
- **Michele Manuel**, Assistant Professor in the Department of Materials Science and Engineering at the University of Florida
- **Orlando Rios**, R&D Staff Scientist in the Deposition Sciences and Technology Group at Oak Ridge National Laboratory

Mid-Career Issues: Panelists
- **Nancy Bingham**, Manager of Inclusion and Talent Pipeline Development for Caterpillar Global Mining
- **Keith J. Bowman**, Professor and Chair of the Department of Mechanical, Materials and Aerospace Engineering at Illinois Institute of Technology
- **Jonathan Ransom**, Head of the Durability, Damage Tolerance and Reliability Branch at the NASA Langley Research Center
- **Linda S. Schadler**, Russell Sage Professor in Materials Science and Engineering and Associate Dean of Academic Affairs in the School of Engineering, Rensselar Polytechnic Institute

Leadership I: Panelists
- **Dianne Chong**, Vice President of Materials, Manufacturing, Structures, and Support in the Boeing Engineering, Operations & Technology Organization
- **Julie Christodoulou**, Director of the Naval Materials Division in the Sea Warfare and Weapons Department of the Office of Naval Research
- **Cindy Heatherington**, Global Vice President of Human Resources for Titanium Metals Corporation

- **Jennifer A. Lewis**, School of Engineering and Applied Sciences and the Wyss Institute for Biologically Inspired Engineering at Harvard University

Leadership II: Panelists
- **Jeannine Carter**, Director of Diversity and Global Inclusion at Newmont Mining Corporation
- **Beth Lewis**, Director of Technology Programs for Precision Castparts Forged Products Division
- **Priscilla P. Nelson**, Head of Mining Engineering at the Colorado School of Mines
- **Julia M. Phillips**, Vice President and Chief Technology Officer at Sandia National Laboratories

A number of highlights emerged from each of the sessions, including:

Early Career
- Harassment is still occurring in many forms. Many participants encouraged others to not be afraid to report and document.
- Small things matter in the workplace—lab coats that fit all shapes and sizes, bathrooms that are easily accessible to both genders, and lactation support for mothers.
- Speak up and keep speaking up, for you and for others.

Mid-Career
- In terms of the definition, mid-career is when the protégé becomes the mentor.
- To make the next advances, one may need to gain new skills and perspectives.

Leadership
- How can a "diverse" person get the message out to a mainstream audience?
- Vibrant exchange of ideas is key among the leadership network.
- Never underestimate peer pressure in being able to encourage progress and address diversity.

EARLY CAREER

The four-member panel for the early-career discussion—Michele Manuel, University of Florida (chair); Andrea Hodge, University of Southern California; Katie Kosloski, Luck Companies; and Orlando Rios, Oak Ridge National Laboratory—spoke freely and purposefully about a number of topics related to diversity and inclusion in the workplace.

The panelists kicked things off by sharing their advice for others in the formative stages of a career in the minerals, metals, and materials profession.

First and foremost, they agreed, early career members need to speak up if they want to continue to advance and make a name for themselves. In other words, just because you are only starting your career, you shouldn't be shy or think you can't contribute. "We all have innovative ideas, and can add value to the companies we work for," commented Manuel.

Another piece of career-minded advice: "People like to hear good news." So, during times of adversity, try to turn things around, try to stay positive, and use your experience to help others overcome their adversity. Don't focus directly on the problem, try to make a positive message out of it.

Panelists next discussed the benefits of having a role model and mentor, and how to go about finding one. One panelist pointed out the difference between a mentor and a sponsor: a mentor is "someone who helps you out and gives you advice but receives no benefit whether you perform well or not." A sponsor, on the other hand, "gives you advice and if you follow it, then they benefit directly."

Some panelists agreed that mentors are most helpful when you are starting out, since they can offer key guidance, especially as you are assigned more complex work. When choosing a mentor, a panelist advised, "look for someone who complements you, someone you respect and like." Another mentioned the need "to have a lot of mentors, not just one." Also, keep your eyes open and make sure you appreciate the advice you are getting. Eventually, you'll see the value of your mentor when people start coming to you to ask for advice.

After a break, it was the participants' turn to react to the day's proceedings. As they had done on day one, attendees gathered in small groups around several tables and discussed the panelists' ideas about achieving diversity in the workplace. They were presented with a similar set of questions to explore individually and as a group, and to offer examples of successes and challenges, and to recommend tools to help others.

Below are answers to some of the questions that were posed to the audience.

Q: What did you hear that surprised you?

Several common themes emerged that were surprising to attendees. Many participants mentioned feeling ignored in the workplace and not being able to fit in, while other people spoke about having issues with biases, harassment, and discrimination. A common theme was the lack of ability to stand up to or report feeling such injustices. This resonated heavily with many participants present.

Also surprising to several members was hearing that one should not be friends with a mentor, though it is acceptable to seek out mentors whom you like and who want to help you. Others found it surprising to hear how ineffective formal and informal mentor efforts can be if there is no training or clear instructions.

"People like to hear good news." So, during times of adversity, try to turn things around, try to stay positive, and use your experience to help others overcome their adversity. Don't focus directly on the problem, try to make a positive message out of it.

Q: What did you hear that resonated most with you?

One line of discussion seemed to stick with the members of several groups: that the panelists (i.e., people with seemingly successful career paths) also have problems saying "no" to requests. As one person stated, "it is always difficult to do, and we all struggle with saying 'no,' so it was helpful to hear how others handle it."

The discussion over the need to speak up in uncomfortable or controversial situations, as in the case of sexual harassment, also resonated with audience members. "It is not our responsibility or space to disguise the acceptability or unacceptability of an action," as one person stated. "We should feel empowered to speak out," even as a junior staff person.

Q: Have you experienced any of the situations described; if so, how did you react or cope?

The feeling of being left out or not being invited to company events (sports games, social outings, etc.), especially by older colleagues, was a common experience shared by early-career professionals. In male-female situations, it can be an extremely sensitive issue, commented one attendee. "You should invite yourself," added another. "Let them know you're interested and it's okay to include you."

Several attendees admitted having observed inappropriate behavior—for example, hearing someone say something discriminatory or lewd to a colleague, or other forms of harassment— not reporting it and then, later, feeling like they should have taken action. Others mentioned

encountering harassment and discrimination at an industry conference and not knowing how to report it.

EARLY CAREER–CURRENT PERSPECTIVES AND RECOMMENDATIONS

After a short break, attendees in this session participated in a slightly different form of Q&A. They left their tables and ventured into an adjoining room where the remaining questions were posted on bulletin boards. Then, the participants were asked to discuss the questions and write their answers on note cards and tack them to the boards beneath each question. The group also was encouraged to walk around and comment on or add to somebody else's response. Listed below is a compilation of the attendees' statements captured on note cards.

1. **What advice can you give to others facing adversity in this career stage?**

    - Be brave—you are probably not the only person facing this challenge, so speaking up will ignite a discussion. Be brave but also keep a positive outlook

    - Keep going—you can make it and will make it.

    - Really practice improving your communication skills in all types of communication (presentation, discussing tough issues, stating your opinion even if it's very different).

    - Seek help—someone else has been through it, or can advocate for you.

    - Adversity creates stronger professionals. Often, supervisors watch how people deal with adversity to gauge if they can see professional growth in their employees.

    - Have confidence in your intuition and then ask others as a check to that gut feeling.

    - Find a mentor who will ask you the hard questions. Give your mentor room, the opportunity ,and the freedom to ask you those hard questions.

2. **Does appearance matter in your workplace? How do you decide what to wear?**

    - Since I am young, I try to dress more professionally, to "look" like a professor.

    - I feel the older men judge me negatively for what I wear, but I feel they would dislike me anyway. Since I am one of the only women, I stand out no matter what, so usually I just wear what I want even if it's girly or pink. I like to think I am setting the standard for future women who come to the lab that they will feel free to also wear what is professional but matches their personal taste.

    - I just try to always be the best dressed person in the room. If you want to be a general, dress like a general!

- Look clean and neat—what matters is what you accomplish, not what you wear.

- I notice that I am treated differently when I dress up (taken more seriously).

- I pay attention to the people senior to me that I admire. I copy what they wear, but always add my own flare.

- Initially, I dressed conservatively (not very feminine) until I felt like I proved myself. Now I dress more true to myself—professional with plenty of feminine touches.

- At conferences, I worry about looking too feminine or fashionable. At conferences, I compromise between comfort and what I see the people I respect / admire wearing.

3. What uncomfortable professional situations have you experienced? How would you see yourself managing these situations in the future?

- Sexual harassment—find an ally.

- Being called "sweetie" at conferences because I look young—unsure how to handle.

- A faculty member calling a student in a minority group a "freak." Unfortunately, I said nothing.

- I have been bullied by co-workers—as an advisor / boss I would ask for professional help in dealing with the situation instead of trying to sort out the situation myself.

- One time, I witnessed someone being harassed in a group and I never said anything. Now, I would say it's a teachable moment and interrupt the behavior, with empathy for both the harassed and the harasser.

- Exclusion is an uncomfortable feeling—get advice from others to be included.

4. What are tactics for dealing with being the diversity representative in your organization?

- Use it to your advantage! Get known and recognized faster by others.

- Pick only what interests you! Learn to say no; your day is also only 24 hours long.

- Use it to create awareness and empower others around you.

- My approach is to do my fair share but no more. I need to succeed in my mainline duties and my own career.

5. What tactics can you offer for dealing with discrimination in performance reviews, salary negotiations, or advancement opportunities?

- Request transparency.

- Gather information. Be able to defend your position, with data wherever possible. It makes your argument stronger and makes you feel more confident in your position.

- Ask questions, be brave and speak up for yourself.

- Know your worth! List what you bring to the organization.

- Always ask for more. Pretend you are negotiating on behalf of one of your successful friends. It is often easier to stand up for someone else because you can feel selfish if you are asking for your own benefit.

- I emphasize the positives in my career and seize advancement opportunities.

- Find a well-informed and empowered ally outside of your management chain to discuss and bounce ideas off of.

6. What tactics do you currently use or recommend for building your professional network and career advancement?

- Find people who have jobs you want, and ask them how they got there.

- Introducing yourself and talking to people you do not know can be awkward—embrace it and do it anyway!

- Challenge yourself to meet "X" new professional contacts each day, at each conference you attend.

- Never underestimate the power of asking nicely.

- Attending conferences and professional development training—easy networking.

- At the end of the day at a conference, I try to write down all the people I had conversations with and a brief summary or one highlight. I find this really helps me remember people and associate things with their names rather than just ending the conference with a big handful of business cards.

- Don't be afraid to talk to older professionals if you are young and need help.

- Informational interviews can be good to meet more people.

- Sometimes saying "yes" will lead to very valuable professional relationships – service for your professional society.

- Quality over quantity. As I create my network, I take time to foster relationships instead of just continuing to meet new people.

- Meritocracy is my tactic – don't pay attention to what I look like, but what I accomplished.

- Invite people in your field to present at your department seminars, or symposia that you organize at conferences.

- Volunteer yourself for some duty in your community.

7. How have you received your most valuable soft skill and leadership development training?

- At an academic advisor training / workshop.

- Taking a self-assessment test and realizing that my dominating style overpowers others. It was very raw and enlightening, and now I value listening much more.

- Actually going to the many seminars that feature this on campus (interviewing, negotiating, difficult situations, etc.).

- Workshops / courses designed for preparing future faculty.

- Attending conferences / workshops / events and networking there. It offered great opportunities to see others in action.

- On-the-job training – taking on leadership positions as a side career.

- Many leadership courses–learning my strengths and weaknesses to work on.

- Volunteering and public speaking competitions.

- Practical work experience and training.

- By being the only X in the room for the majority of my educational and professional experience and learning to look at things through the perspectives of others.

- Leadership training, community service, friendships.

- By pushing myself outside my comfort zone (it's scary but worth it).

- Being vice president and president of a student club.

- Mentoring younger students going through challenges similar to those I went through.

- Most of my leadership training came from industry and I now apply it in academia. Academics should make a more concerted effort to provide such training.

8. How did you find your role model, mentor, sponsor, or advocate? (Provide a working definition of each of these groups.)

- Academic advisors who also became mentors.

- Mostly through finding similar approaches to dealing with various work situations.

- Through graduate school and grant proposal collaboration.

- Through a summer internship during my undergraduate years.

- Role model–showed me what I wanted to do. Mentor–showed me how to get there. My role models were great scientists in my field.

- Sought out a mentor who I know is well-connected and influential and is willing to make introductions and takes the time to give advice.

- I have so many mentors–most are former bosses (from internship in industry or academia), but many are people I met at conferences. Usually they are people I tried to engage by asking about their career trajectory. I agree–formal mentorships have never worked for me, so I draw upon my entire network for advice.

- Asked people for help and they took an interest.

- I've had a variety of wonderful mentors and found that when I step outside my comfort zone and try something new, I meet fantastically new communities of people I would otherwise not have met–volunteering, exploring a new research area, sometimes just emailing is all you need to do.

- Spent a long time interviewing for my position to find a boss who could also serve as a mentor.

- When thinking about career options, went to two professors who were friendly and open and asked for advice. They had different experiences, so offered different perspectives..

9. What is your employer doing to help you with the competing demands of dual careers and family life? What could they do better?

- Flexible time and work from home.

- Try to educate co-workers that just because people work flexible hours does not mean that they are bad workers.

- Understanding my efforts to combine family and career—I always felt highly appreciated.

- Flexible schedule, comp time, prioritizing work to make sure important work is done first.

- Help with lactation space—need to work on maternity leave and policy and childcare.

- Could do—more access to quality childcare and clearer policies.

10. What is the single best practice that your workplace instituted to advance diversity and inclusion?

- A mentor-protégé toolkit.

- Setting up a system for training in advancing diversity and inclusion for people reporting to me.

- A sense of community, started as early as hiring / recruitment, that is promoted by informal social events bridging faculty, staff, and students.

- Inviting people who have experienced discrimination to speak about how they overcame these challenges.

- Clear expectations for CEO, accountability for diversity and inclusion in succession planning.

- I have not seen any official thing make a difference—I am lucky to work with people that personally are inclusive or at least not discriminating.

- Fostering a sense of community—a community where open communication is highly encouraged.

- Diverse managers, leaders and senior staff that interact with early career staff.

- By creating a sense that diversity in all aspects is positive. Diversity is empowering.

- Encouraging feedback.

- Creating an environment where you can share feelings and emotions without fear of being punished or thought less of.

EARLY CAREER–WRAP-UP

In closing out the session, attendees were asked to share highlights and add their comments, which follow:

- The fact that gender-based harassment continues to be an issue in the workplace was surprising.

- It was interesting how someone spoke about the fact that just bringing up someone's race or minority status will make them feel lower. In doing so, they bring attention to the stereotypes associated with their minority status.

- I do think race harassment occurs, in many cases when the harasser does not even know it. I was approached by a colleague and she mentioned that she had a granddaughter who was "unfortunately" of a mixed marriage—she jokingly said her son-in-law went to a different college than her daughter. While she may thought it was a harmless joke, it made others feel uncomfortable and it's important to address behavior like this early on to avoid future issues.

- I think harassment is something we will keep encountering. I do not think the solution will be that there will be no harassment, but we can provide tools on how to deal with this for the people coming in the future. The sensitivity of every person is unique so tools are necessary to deal with this harassment throughout our professional careers. You learn how to deal with it by discussing it and listening to other opinions. We need to educate our colleagues.

- There are multiple levels of action that are needed to stop harassment behavior. Take action.

- When you're having trouble taking action, find an advocate!

MID-CAREER

Jonathan Ransom, NASA Langley Research Center, speaks to attendees of the mid-career breakout session.

The four-member panel for the mid-career discussion—Keith J. Bowman, Illinois Institute of Technology (chair); Nancy Bingham, Caterpillar Global Mining; Jonathan Ransom, NASA Langley Research Center; Linda S. Schadler, Rensselaer Polytechnic Institute—spoke about many topics pertaining to diversity and inclusion in the workplace.

The chair asked the panelists a number of questions about common issues and challenges faced by mid-career professionals in the minerals, metals, and materials profession.

Questions:

- What has been your most positive, affirming experience relative to diversity and inclusion where you are currently working, and how has it influenced why you are here today and overall?

- What advice can you give others who might be facing adversity or challenges in this stage of their career?

- Have you had uncomfortable professional situations? If so, can you describe them and how you handled them? How would manage these situations in the future?

- How do you assess whether the policies of your institution or organization are being practiced, and is there accountability for them?

- What are the tactics for dealing with being a diversity representative or being seen as a diversity representative for your organization?

- What approaches have you taken to deal with discrimination in performance reviews, salary negotiations or advancement opportunities, either for yourself or for others?

- What tactics or approaches do you take for building your professional network in career advancement and what would you recommend in that context?

- How have you found support groups or role models in your career?

- What is your employer doing to help with competing demands of careers and family life? Describe a best practice that your workplace has instituted to help with work-life balance.

The above questions inspired a great deal of dialogue among panelists and additional questions, outlined below, furthered that discussion with. Following are highlights from their discussions.

Q: What did you hear that surprised you?

One of the things that surprised members of the group, which comprised a mix of representatives from several sectors (industry, academia, government), was the perception that there are many similarities and yet vast differences in the way each is organized. For example, in terms of organizational structure, there is slightly more of it in industry than in academia, which seemed to be made of "very loose networks," to quote one of the participants. Or, as someone else said: "So, in industry, as frustrating as it might be to try to navigate the system, it seems like in academia it's a lot more nebulous."

Q: What did you hear that resonated most with you?

Several people responded to Linda Schadler's discussion of her personal mission statement, her core values, as it relates to work-life balance. "That resonated for me because that is something that I think everybody should be thinking for themselves and in their whole career planning and in where they want to go with things," was one comment.

The concept of "mini-mentors" garnered much interest. Mini-mentors are different people who, at different points in a person's career offer a perspective that is really valuable at that moment. "You don't always have to think in terms of a lifelong relationship" when it comes to mentors, one participant commented.

Q: Have you experienced any of the situations described; if so, how did you react or cope?

Several people discussed their personal situations, which generated a lot of talk, including an incident involving "misogynistic attitudes and comments" that were made in the workplace, physical and emotional intimidation, and their repercussions. As is often the case, once a person takes the steps to report such things to a manager and then to human resources (HR), "you usually

find out that you are not the first one to complain," one member noted.

Other discussions touched on such issues as personal attire and behavior modification, the problem of the double standard being applied by managers, and the role of mentors in these situations.

MID-CAREER—CURRENT PERSPECTIVES AND RECOMMENDATIONS

After a short break, attendees in this session participated in a slightly different form of Q&A. They left their tables and ventured into an adjoining room where the remaining questions were posted on bulletin boards. Then, the participants were asked to discuss the questions and write their answers on note cards and tack them to the boards beneath each question. The group also was encouraged to walk around and comment on or add to somebody else's response. Listed below is a compilation of the statements from attendees captured on note cards.

1. What advice can you give to others facing adversity in this career stage?

- Talk to peers and managers. Communicate to someone and seek assistance.

- Hang on and find advocates; later it might not seem as adverse.

- Talk to your HR representative if you feel uncomfortable speaking to your manager.

2. Does appearance matter in your workplace? How do you decide what to wear?

- Cleanliness and neatness do impact impressions—what makes me comfortable for the context.

- Yes, and this is more difficult for women. Rule is—make sure what you are wearing is not distracting from your message. They should remember you. Not your clothes.

- Different regions of the country (e.g., northeast vs. west) have different levels of concern about appearance.

- Didn't matter as much early in my career, but seems to be increasingly more important at higher levels.

- Exercising good judgment about dress, appropriate to the situation, says a lot about your professional maturity.

- I think it is important what you wear. I decide what to wear based on my nature to put forth my best appearance. Hence, I err on the side of being overdressed (too formal). However, in the evolving workplace, I have begun to embrace diversity in attire as well.

- Neat and clean appearance varies my work location.

- Yes— professional dress impacts perception; depends on the venue; changes for typical work day versus board meetings (i.e., dress for the situation).

- I find the balance between the right level of formality and what I'm most comfortable wearing. I try to never be the most casually dressed person in the office.

3. What uncomfortable professional situations have you experienced? How would you see yourself managing these situations in the future?

- When others are being outspoken (often showing some bigotry) in one-on-one situations. They think you are agreeing, you need to make it clear you don't agree.

- Being asked about my family or children.

- Depends on the context.

- Physical / sexual harassment.

- Report immediately—let offender know this is unacceptable and establish boundaries.

- Use the opportunity to select the positions / commitments you want and learn to say no to the rest.

- Pick your battles.

- Give respect—listen, command respect, be prepared.

- Find and cultivate allies and supporters.

4. What are tactics for dealing with being "the" diversity representative in your organization?

- Don't give up.

- Understand your organization's demographics and industry demographics.

- Have a short-term and long-term plan.

- Have a model.

5. What tactics can you offer for dealing with discrimination in performance reviews, salary negotiations, or advancement opportunities?

- Encourage transparency and openness in your organization.

- Make these conversations about results (measurable attributes).

- Increasing transparency in evaluations.

- Talk to HR.

- Have standardized tools and processes.

6. What tactics do you currently use or recommend for building your professional network and career advancement?

- Participation with professional societies and being on program committees for scientific meetings.

- Talk to people outside your work group. Sit at the table in the cafeteria and meet new people. (I wrote up a patent application with some people I talked to in a hallway conversation.)

- Don't be afraid to learn about new areas.

- Understanding the interconnectivity of all areas of your business will give you more informed ideas.

- Actively participating in professional society activities (i.e., being a TMS volunteer).

- Technology conferences / forums, professional societies, technical committees / board participation.

- Broad sweep or connecting with people and being seen as open and outspoken.

- Help others when you can.

- Networking internally and externally, informal and formal engagements.

- Being someone that others want to work with.

- Volunteer for projects outside your job.

7. How have you received your most valuable "soft" skill and leadership development training?

- Watching leaders in situations (good and bad) in the workplace.

- When experts with data presented it (I trusted them).

- Selected to participate in a leadership skills training course. Being part of community organizations / nonprofits.

- Watching others.

- Leadership training in college and grad school (a long time ago).

- Through government, Office of Personnel Management (OPM), and Brookings training courses.

- HR workshop on managing different personalities and working styles.

- Watching others I respect and admire—especially those with similar styles.

8. **How did you find your role model, mentor, sponsor, or advocate?**

- Look for people I respected professionally.

- Someone you have something in common with – does not need to be gender, race, etc.

- Tech mentors—seek those whose work I respect.

- Business leadership—non-work environment, also.

- Friends in senior business positions who have world experiences.

- Observe how they behaved and reacted to difficult situations.

- Compare their answers to my questions in relationship to the answers provided by others to the same questions.

9. **What is your employer doing to help you with the competing demands of dual careers and family life? What could they do better?**

- Flexible scheduling, Family Leave Medical Act / vacation for elder care issues.

- Telecommuting, and management taking advantage of telecommuting policies, makes it easier for all staff to feel comfortable doing so.

- Could give more lower-level employees more decision-making authority (currently a lot of extra meetings).

- We work with other employees collaboratively.

- Flex work time and no late / early mandatory activities.

- Flexible work schedule—a changing culture about what it takes to get ahead.

10. What is the single best practice that your workplace instituted to advance diversity and inclusion?

- Increase transparency.

- Formalizing processes to level playing field.

- Telecommuting and web meetings—allows for work-life balance and inclusion of those who might not be able to participate in person (i.e., new mothers).

- Providing an identified senior management advocate / leader.

- Invoking a "no questions asked" policy for tenure clock.

- Mentoring Circles (formalized process).

- Diversity awareness via seminars and other means.

- More open discussions and seminars about diversity and inclusion. Actions are still pending in my opinion.

MID-CAREER—WRAP-UP

In closing out the session, attendees were asked to share highlights and add their comments, which follow:

- The term mid-career is hard to define but I think this session really hit on the issues that you would experience when you transition from early to mid-career.

- For me, mid-career really is that transition from being the protégé to being the mentor. It can be gradual or it can be an abrupt job change and that may be a good indicator of that transition.

- One of the things we talked about in the awards committee, we discovered we had awards for people just starting out and then we had awards for the senior people. We realized there was nothing there for the people in mid-career; when this was discussed we instituted awards that do recognize mid-career professionals. Organizations can fall into a similar trap of not recognizing mid-career employees so it's important to remain cognizant of their contribution and support needs.

- As an academic, it appears to me that associate professors are sometimes the most unhappy so indeed there is need for mid-career support and assistance.

LEADERSHIP I

There were four panelists in the Leadership I discussion, which focused on skills development:

- **Dianne Chong** (Chair), Vice President of Materials, Manufacturing, Structures, and Support in the Boeing Engineering, Operations & Technology Organization
- **Julie Christodoulou**, Director of the Naval Materials Division in the Sea Warfare and Weapons Department of the Office of Naval Research
- **Cindy Heatherington**, Global Vice President of Human Resources for Titanium Metals Corporation
- **Jennifer A. Lewis**, School of Engineering and Applied Sciences and the Wyss Institute for Biologically Inspired Engineering at Harvard University

Following the panelists' remarks, the audience was asked a few questions to further the dialogue:

Q: What did you hear that resonated most with you?

Mentoring resonated very strongly across the leadership-level academic participants at the summit. They discussed the experiences and perspectives of the speakers on formal versus informal mentoring and the various ways that mentors provide immeasurable value to their protégés, including providing the internal pathways and assisting with personal strategies.

They also spoke with relief about the assertion from one of the speakers that leaders do not have to be the best at everything. Also of interest were the data reflecting the change in work-life balance across the years.

A robust discussion considered the contrasting recommendations from the speakers on two different hiring strategies (both without gender or race bias):

- Hire the best-qualified candidate
- Hire the candidate with the greatest perceived potential

Academic leaders also discussed the pipeline challenge—of fueling interest in the minerals, metals, and materials fields in early childhood and focusing on getting more female students into engineering. Participants shared thoughts about the potential impact of expanded internships as a means of encouraging more diversity in graduate students. The leaders also discussed challenges with raising the next generation of leaders in the university when younger staff are exhibiting impatience and moving around rather than establishing deep roots with an institution.

Q: Have you experienced any of the situations described; if so, how did you lead through the challenge?

The academic leaders recognized that they have room for improvement in the area of mentorship.

Many felt they need to make and keep a commitment to helping the junior faculty and inspiring their colleagues to do the same. Many wanted to lead by example and by sharing how other others mentored them at earlier stages of their careers.

One of the challenges that several participants faced was being the only representative of an under-represented group in their department. When in the department leadership role, successful leaders have been steadfast and patient in earning respect and leading authentically. Some leaders shared that they have become weary of being tapped as the "minority" representative on so many committees; they have taken the proactive position of informing others that they cannot always be a resource for the minority voice. One leader spoke about the challenge of feeling isolated and not belonging in her field; she proactively hired a career coach and sought advice from other leaders in underrepresented groups and worked to develop her personal leadership style.

The female leaders spoke about the challenges of work-life balance for themselves and for their faculty. They shared the importance of leading by example—preserving time for family and being sensitive to the needs of their faculty to fulfill family commitments.

One academic leader spoke about feeling insulted when asked, "What is your American name?" He responded with a phonetic spelling and pronunciation of his name and advised the group to be sensitive to the importance that an individual's name has on their identity and pride.

LEADERSHIP I–CURRENT PERSPECTIVES WITH FOCUS ON TACTICS

Q: What is the single best practice that your workplace instituted to advance diversity and inclusion?

Leaders provided a host of practical actions instituted at their universities to promote and assure diversity and inclusion in hiring faculty. These include:

- Establish a mentoring committee

- Provide information package to candidates on the diversity and inclusion polices of the institution, including family-friendly practices.

- Provide two industry coaches (male and female) out of HR

- Identify position and what you are looking for prior to opening the application in order to customize the resume build template

- Provide a faculty coach position within the school or college funded by school so faculty can access coaching for career advancement and relationship development with their faculty

- Provide an accompanied partner / spouse hiring program

- Frank discussions on the value of inclusion to the organization

- Industry partnership with university

- Programs / funding to hire diverse candidates

- Increase candidate pools to include diverse candidates

- Engage with nearby schools to recommend diversity candidates to attend university grad school workshops and seek application

Q: What is the biggest challenge in developing a diverse workforce?

Leaders considered various challenges in developing and maintaining a diverse workforce. At the top of the list is access to a robust pipeline of diverse candidates as a result of continuing low participation in STEM-based education by female students and underrepresented groups. Universities tend to focus on academic careers and do not provide a broad enough picture of career options in industry. Even with the available pool of diverse candidates, one engineering discipline takes from another so the net increase is minimal. Traditionally the "best candidate" criteria has been narrow enough to exclude some diverse candidates with credentials that are not part of the current criteria. Offshore opportunities are more robust in technical areas—in the United States, advancement often takes professionals out of research and into administration or management.

Q: What are the most important factors to retaining a diverse workplace?

Leaders identified the workplace environment as the most important factor in retaining a diverse workforce—with leadership that supports diversity and tools for professional development and career advancement. The participants noted that diverse professionals may have cultural needs and interests that differ from traditional white male faculty.

Q: How do you advocate for diverse employees in your organization?

In addition to publicly espousing inclusion and diversity, universities advocate for diverse employees by participating in ADVANCE grants, offering graduate scholarships specifically to underrepresented groups and veterans, providing future workforce and summer intern programs, and celebrating different cultures on campus. Faculty mentoring programs are also effective.

Q: How have you advised someone to find a role model, mentor or advocate?

Leaders shared their experiences in advising individuals to find a role model, mentor, or advocate, including connecting individuals with matching interests, recommending multiple mentors, and encouraging informal mentoring opportunities

Q: What tactics do you currently use or recommend to nurture your own / your employees' professional network and career advancement?

Leaders shared the following ways in which they nurture the professional network and career advancement of their own employees:

- Put them on a high-visibility project assignment, with good support for success

- Send employee(s) to emerging leader education and development

- Give credit where due to subordinates; take leader accountability for team failures

- Encourage employees to take many different jobs / opportunities within the agency, encourage a jump to something outside the comfort zone

- Encourage students / interns to meet a large number or people / mentors

- Support employee travel to professional conferences

- Nominate for awards, make introductions to collaborators

Q: How do you identify someone to mentor?

Leaders who are looking for individuals to mentor find them in various ways. They ask employees in informal conversations about their interests in coaching. They respond to those who request mentoring or coaching. They promote mentoring opportunities in meetings and encourage individuals to ask questions.

Q: What could your employer do better to help you with the competing demands of dual careers and family life?

Leaders cited that better workload distribution and a more appropriate analysis of workload when hiring or retaining would assist them and their employees with competing demands of dual careers and family life. Flexible hours with common core hours of 9:00 a.m. -2:00 p.m. provides both flexibility and supports productivity.

LEADERSHIP II

Panelists take part in the Leadership breakout session. From left to right: Julia Phillips, Priscilla Nelson, Jeannine Carter, Beth Lewis.

There were four panelists in the Leadership II discussion, which focused on the workplace environment:

- **Beth Lewis** (Chair), Director of Technology Programs for Precision Castparts Forged Products Division
- **Jeannine Carter**, Director of Diversity and Global Inclusion at Newmont Mining Corporation
- **Priscilla P. Nelson**, Head of Mining Engineering at the Colorado School of Mines
- **Julia M. Phillips**, Vice President and Chief Technology Officer at Sandia National Laboratories

Following the panelists' remarks, the audience was asked a few questions to further the dialogue:

Q: What did you hear that resonated most with you?

Leaders found that many of the panel's comments resonated with their own experiences. In particular, that "equal does not mean the same." They agreed that sometimes the message needs to be delivered by someone else, someone who has credibility or cultural connection with the audience. Mentoring is an important and challenging role at all levels of organizations. Professional societies may be a great resource for encouraging diverse candidates and providing networking opportunities.

Q: Have you experienced any of the situations described; if so how did you react / cope?

One female leader had already offered the same recommendation as was voiced at a later date by a male colleague. It was passed over when she offered it and accepted when the male colleague offered it. She just shrugged it off. Another female scientist was feeling very isolated until she discovered a women's network and realized that she is not alone and has a network of female professional engineering colleagues.

LEADERSHIP II–CURRENT PERSPECTIVES WITH FOCUS ON TACTICS

Q: What successes can you share in supporting career development and advancement of others in your organization, especially members of a minority group?

Academic leaders spoke about activities and volunteer work that supports the advancement of others, especially members of minority groups.

- Negotiating equivalent benefits for women

- Encouraging participation in programs that cross-cut the university departments

- Sponsoring a monthly women's happy hour

- Leading future faculty workshops

- Serving on thesis committees

- Working in the university diversity office

- Encouraging writers' groups
- Choose to focus on most impactful activities

Q: How has serving as a role model, mentor or advocate for a member of a minority group been valuable?

Individual leaders shared their own successes in mentoring and advocating for members of a minority group, including:

- I helped a first-generation Chinese employee understand expectations in work and culture.

- I mentored an African American graduate student and helped him develop research skills, complete M.S. thesis, and obtain an R&D job in a government lab.

- I mentored multiple undergraduate students and provided research opportunities that cultivated their interests in materials engineering and retained them in this profession.

Q: How have you managed any discrimination or perceived discrimination in performance reviews, salary negotiations or advancement opportunities among your staff?

Leaders reported a continuing bias against women who negotiate aggressively for salary, ratings and advancement versus men who do the same. Improving transparency is a means to manage this bias more effectively.

Q: What advice can you give to others facing challenges in this career stage?

Leaders provided insights and encouragement to professionals facing diversity challenges that included:

- Stay focused and work hard.

- Do not ever settle or relax because you think you are secure; keep things moving.

- Ask for 360 feedback reviews; maintain open communications.

- Know what questions to ask.

- Earn respect and treat others with respect.

- Trust yourself; be more action oriented.

- Become comfortable with being uncomfortable.

- Allocate your time strategically.

- Choose to focus on most impactful activities.

Q: What are success stories involving minority or underrepresented members in professional or leadership developmental programs?

- Hiring more women engineers who are ultimately increasing the pool of qualified candidates in the leadership pipeline pool

- Now have a department of 100 percent minority or underrepresented members

- Developed a STEM program to encourage youth to go into engineering and manufacturing; also, training programs to develop trade skills for industry positions

Pictured on right: Mildred Dresselhaus, Professor of Physics and Electrical Engineering, Emerita, Massachusetts Institute of Technology

Closing

CLOSING PLENARY

"Diversity Throughout Science and Engineering"
By Mildred Dresselhaus
Massachusetts Institute of Technology

For the closing plenary lecture, attendees heard from Mildred Dresselhaus, one of the profession's most-decorated and accomplished female members.

In her talk, Dresselhaus, who began her career in 1960 as a member of the research staff at the Massachusetts Institute of Technology (MIT) Lincoln Laboratory, after earning a Ph.D. at the University of Chicago and a two-year post-doctorate at Cornell University, provided a contrast to the previous days' discussions by offering a larger, global context of diversity and inclusion issues throughout science and engineering. She also provided some levity and grounding about the pleasures of working in the profession.

"Most of us are drawn to science because we love it. I still wake up thinking about science every day," she said. "There are very few professions that have the same level of satisfaction as a career in science and discovery. And it seems to me that we should be teaching our young people that the best thing you can do is combine enjoyment with your life's work. And that is what I have been able to do."

Dresselhaus said that her upbringing as the child of immigrants living on the "wrong side of the tracks," her ability to overcome personal, professional, and institutional challenges and biases along the way, and her determination (with both pluck and, in some instances, sheer luck) lead to a long and distinguished career in science and engineering.

She described how her interest in research led to her appointment as an MIT faculty member and eventually as a professor in the departments of physics and electrical engineering. She also went on to serve as director of the Office of Science at the U.S. Department of Energy from 2000 to 2001 and has served as an officer in many national organizations and physics engineering and related areas.

She emphasized that her success stems from her belief in self-reliance. It is in some ways daunting to consider "the improbableness of my being here," she said. "And yet, I believe, and always have, that anyone can do this. You have to want it, and you have to work at it." Dresselhaus, who worked full time and was married with four children, added that she was inspired throughout her career by the achievements of others, especially other pioneering women in the sciences who often became her mentors.

Despite all the progress that has been made to increase diversity throughout the various fields of science and technology, Dresselhaus stated that equal entry for women and minorities has not yet been achieved. She offered numerous reasons why that is the case, and how it continues to be so, and emphasized that it is, in her mind, "in the public interest to achieve this goal." Dresselhaus, whose achievements include 31 honorary doctorates worldwide, the National Medal of Science, the Nicholson Medal for Humanitarian Service, and the Fermi Prize, suggested that continued discussion within both the scientific community and the public sector is desirable and necessary.

"In this way," she added, "I am delighted to be here and to have this opportunity to give my input on the subject as we look to the future."

EVENT SUMMARY AND HIGHLIGHTS

Elizabeth Holm
Summit Organizing Chair and Professor, Materials Science and Engineering, Carnegie Mellon University

Wrapping up the final morning of DMMM1, Elizabeth Holm, summit organizing chair, said she had spent much of her time over the previous three days "moving from session to session, taking notes, and putting things together" for her final overview presentation. Her goal, she said, was to foster a dialogue with the remaining attendees about the outcomes, views expressed, and individual experiences of the summit.

She provided a recap of the opening speakers' presentations and the key challenges they identified. The first was the impact of data. As noted in Mary Galvin's talk, the population in STEM disciplines and STEM education doesn't resemble the U.S. population. This means, Holm said, "We are missing people that we could be including."

Another key challenge that Holm identified from Galvin was "how to leverage the advances made by women to include the underrepresented minorities in our field." Most minorities—African Americans, Hispanics, and Native Americans—have not kept up or have not shown the same improvement over the same years. Additionally, she asked, how do members of the profession adjust the tactics, goals, and metrics—"everything we think about diversity and inclusion"—as they achieve success?

She went on to offer highlights from the three keynote presentations, representing each of the three sectors. According to Holm, the talks could not have been more different in content and style, but several common themes emerged throughout the discussion:

- Leaders at the highest levels must create the culture and, more important, have to directly take action themselves, not assign or delegate or simply talk about it. In other words, "you do have to walk the walk and talk the talk."

- Mindful recruiting—that is, attentive recruiting to diversity issues—is essential in all

the sectors. One can't expect diversity to come naturally; it requires training and support structures, along with the commitment to keep them vibrant.

- Diversity goals are moving past the numbers and to an inclusive workplace.

- On day two, during the early-career track breakout session, Holm noted that—"surprisingly and worrisomely"—harassment is still occurring in the workplace and, as the group suggested, it is incumbent upon senior leadership to stamp it out. "Report and document; it's so important," Holm said. She also reported that "small things matter to the early-career person." For instance, Holm said, do lab coats fit? Are bathrooms conveniently located? Is there lactation support for mothers? Conveniences that require very low levels of investment are important, she said, especially in the early-career stages. A pleasant surprise, Holm added, was hearing about the mutual support early-career professionals were giving each other: encouraging one another to speak up and keep speaking up, to reach out and make sure their voices are heard, to be brave. It was wonderful to see that level of networking and support, she said.

What surprised Holm during her visit to the mid-career breakout session was how long the attendees spent defining the term "mid-career." Although achieving consensus was difficult, Holm was pleased with the agreed-upon definition: "when the protégé becomes the mentor." To make such a transition, one may need to gain new skills. Recognizing that there isn't much support for doing just that, Holm noted that some attendees made excellent suggestions for making that next step.

The other theme that caught Holm's attention was the idea that, when the glass ceiling is moved to a higher level (i.e., to the vice president and president levels) the opportunities may become less desirable to people who have dual careers or who have families and children. If that's the case, she noted, what can be done to change the dynamics? "Who doesn't want to be CEO?"

Holm noted that, in the final breakout session, the leadership track, attendees were very frustrated that any discussion of diversity among a mainstream audience always causes people to question, "Are you trying to mess up my carefully planned workforce?" This prompted "a vibrant exchange of ideas" among the leadership networkers, Holm said, including the reminder that one should "never underestimate the power of peer pressure." So many organizations proved to be doing a great job managing diversity, she noted, "and that means yours can, too—feel the pressure, it's a good thing."

Holm summarized her observations by offering five themes, serving as guiding principles that emerged again and again throughout the sessions:

- **Mentorship**—There are many kinds of mentors, Holm stated, not just in the conventional sense (find someone to help you), from so-called mini-mentors to role models to mentors who don't even know that they are being mentors. The important question, Holm noted, is how can we train people to be a good mentor?
- **Work-life balance**—Everything from "tenure clocks" to flex time and maternity leave—

issues about having a "whole life" came up again and again among attendees.

- **Community**—Another recurring theme was the desire to foster a sense of community, and communities within communities, a sense of belonging, once a level of diversity and inclusion has been reached.
- **Awareness**—Holm noted that this theme showed up at many levels, from the basic ("How do we make sure people are aware of diversity issues?") to the complex ("How do we train people who don't want to attend training?") to the critical ("How do we sustain these issues, and the awareness of our leaders?")
- **Vigilance**—As Holm stated, "We have to keep watching, keep measuring, keep improving, and these ideas came up in every single breakout session, in one form or another."

Her final take-home message was a call for advocacy. "Go home and talk with whoever you look to as your boss, your manager, your supervisor. Discuss one of the good ideas you've heard here, whatever one resonated with you—whether it's starting a research group, getting a facility of a particular type, fighting for the properly fitting laboratory gloves, etc. Next week, when you are back at work, have a meeting with your boss and convey that to him or her." She added, "I think that if we all do that, we'll really make a big difference coming out of the gate of this summit."

Appendix 1:
Post-Summit Survey Results

SUMMARY

Following the conclusion of the First TMS Summit on Creating and Sustaining Diversity in the Minerals, Metals, and Materials Professions, participants were surveyed to gauge immediate responses and reactions.

The 12-question survey, conducted by email via SurveyMonkey, began about two weeks after the summit and was open for two months. Questions touched on a number of areas from overall impressions of the event and general feelings toward the topic to specific details about respondents' personal lives and experiences.

Most agreed that the speakers were interesting and on message, the data and information delivered were important, the workshops provided practical solutions, and the networking opportunities were empowering. The survey results also revealed an interesting perspective on attendees—the majority of respondents were from academia, 25-45 years of age, and overwhelmingly white females.

Following is an overview of the key findings and insights from the survey.

Comments in response to the question, "What is your overall impression of this first TMS diversity summit?" were mostly positive and constructive:

- I really enjoyed the conversations and meeting people across the academic, industry and government career paths.

- I thought this was a great opportunity to talk and gain insight on inclusion from around the industry. There was a much larger representation of academia in attendance, so it would be great to get a more diverse group from private industry and research and development to participate next year.
- My overall impression of the summit is that it was timely with an excellent balance of participants from industry/academia/government. From my observation, the participants were engaged and the interactive format for the breakout session was a plus.

Comments in response to the question, "Which specific diversity issues should be addressed at future conferences?" were varied and wide-ranging:

- More on race and cultural diversity.
- The summit should be very clear if it has just a U.S. or a global focus. Most of the "diversity" discussed was U.S. based only. Perhaps there's a more progressive way to define diversity beyond the traditional gender and race.
- Other issues: Economic status; LGBQT; disabilities (both mental and physical); age.
- I would like to see more emphasis on race, and the specific issues that racial minorities face. Combining race and gender meant that sometimes the conversation focused on improving conditions for women as mothers, which is very important. But it is not as readily apparent as to the barriers for racial minorities within engineering. What is keeping them from these fields, why do they leave, how do we help them?

ATTENDEE DEMOGRAPHICS

Gender

- Male
- Female
- Prefer not to answer

Race

- Asian/Pacific Islander
- African American
- White/Caucasian
- Prefer not to answer
- Other

Work Environment

- Academic/University
- Government/Federal Laboratory
- Industry
- Consultant
- Other

Job Function

- Professor/Instructor
- Engineer/Scientist
- Management
- Student
- Other

7.5%   12.5%   37.5%

22.5%   20.0%

Age

- 20-24 years
- 25-34 years
- 35-44 years
- 45-54 years
- 55-64 years
- 64 years and older

12.5%   7.5%   22.5%

12.5%

17.5%   27.5%
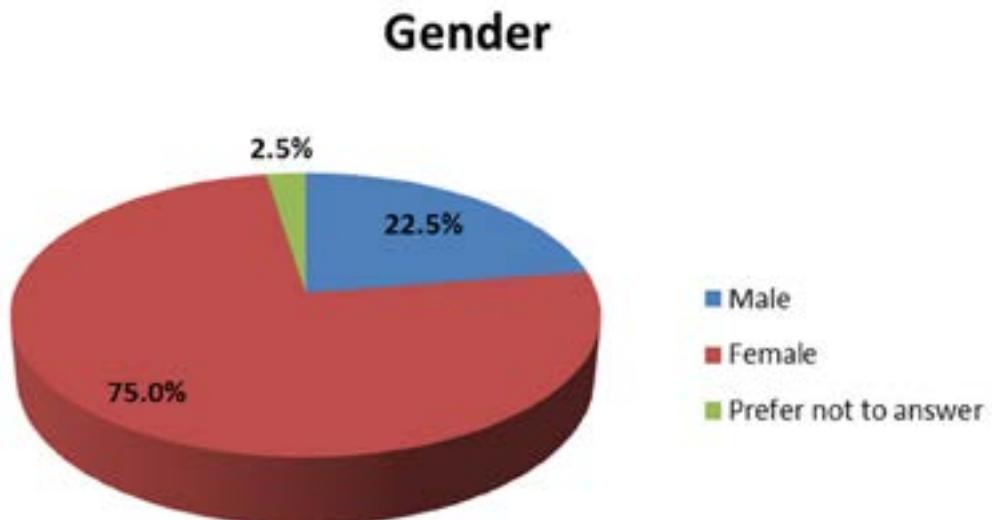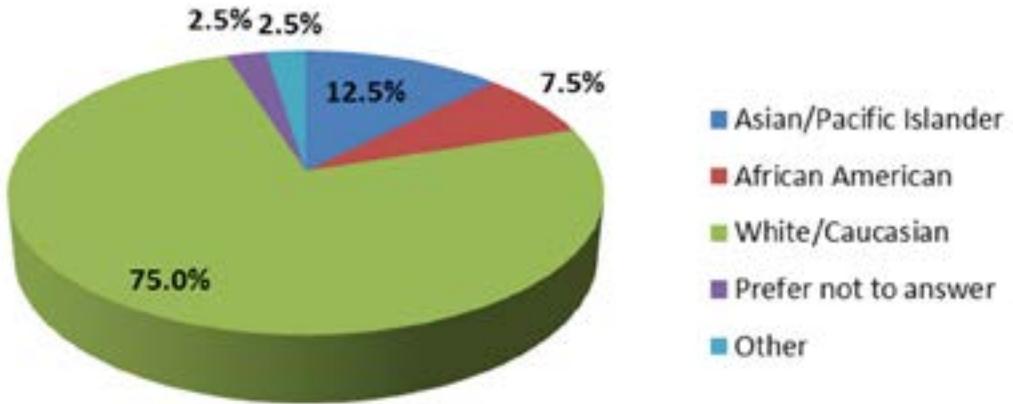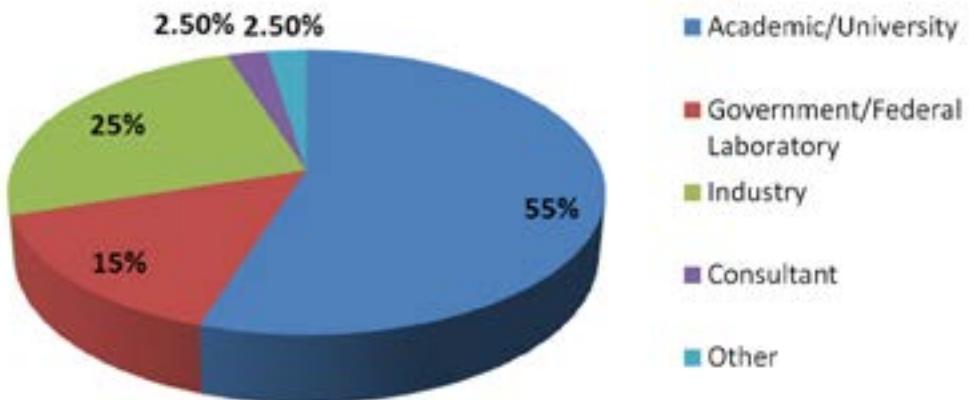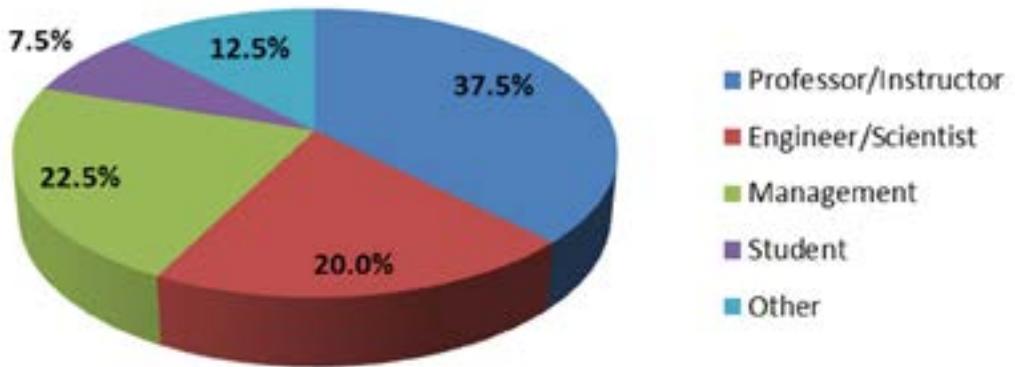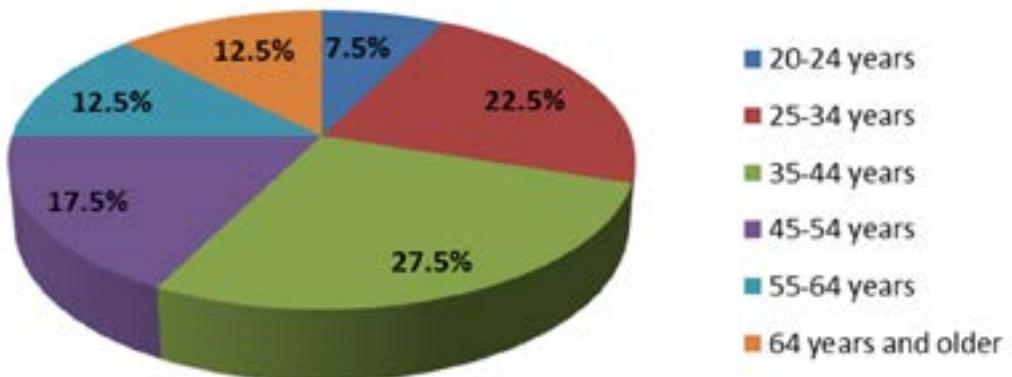
Appendix 2:
Acronyms and Abbreviations

Acronym or Abbreviation	Definition
AIME	American Institute of Mining, Metallurgical, and Petroleum Engineers
ASEE	American Society for Engineering Education
DMMM1	The First TMS Summit on Creating and Sustaining Diversity in the Minerals, Metals, and Materials Professions
DOE	Department of Energy
KPI	Key performance indicators
MMM	Minerals, metals, and materials
NAE	National Academy of Engineering
NSF	National Science Foundation
SME	Society for Mining, Metallurgy & Exploration
STEM	Science, technology, engineering, and math
SWE	Society of Women Engineers
TMS	The Minerals, Metals & Materials Society
URM	Underrepresented minorities

"Change, if it is going to be made and to be lasting, must come from within. Leaders shouldn't just preach to the choir, they should be the choir."

-Johnnie DeLoach, Naval Surface Warfare Center

TMS
The Minerals, Metals & Materials Society

Promoting the global science and engineering professions concerned with minerals, metals and materials