



Attracting and Retaining Technical Women—What Works?

Strategies Within — Forging New Realities for Women in Science, Engineering, and Technology

A Report issued to the Commission on the Advancement of Women and Minorities in Science,
Engineering and Technology Development (CAWMSET).

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Executive Summary

Strategies Within – Forging New Realities for Women in Science, Engineering, and Technology was a one-day forum focusing on creating new strategies to aid in the attraction and retention of women working in technical roles. Over 100 women attended to develop the input for this report for delivery to the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET), established by Congress in October 1998.

This report includes recommendations for policy initiatives and characteristics of best practices for the attraction and retention of women in the technical workplace. Although the educational pipeline is of keen interest to those who attended the forum and is an important element of the Commission’s work, it is not part of this report.

Figures 1 and 2 provide the background and reason for these recommendations¹. As shown, the percentage of women and minorities attracted to scientific and technical fields is much too low, and the percentage of women and minorities seeking higher degrees is even lower—another potential indicator that retention levels in scientific disciplines also drop.

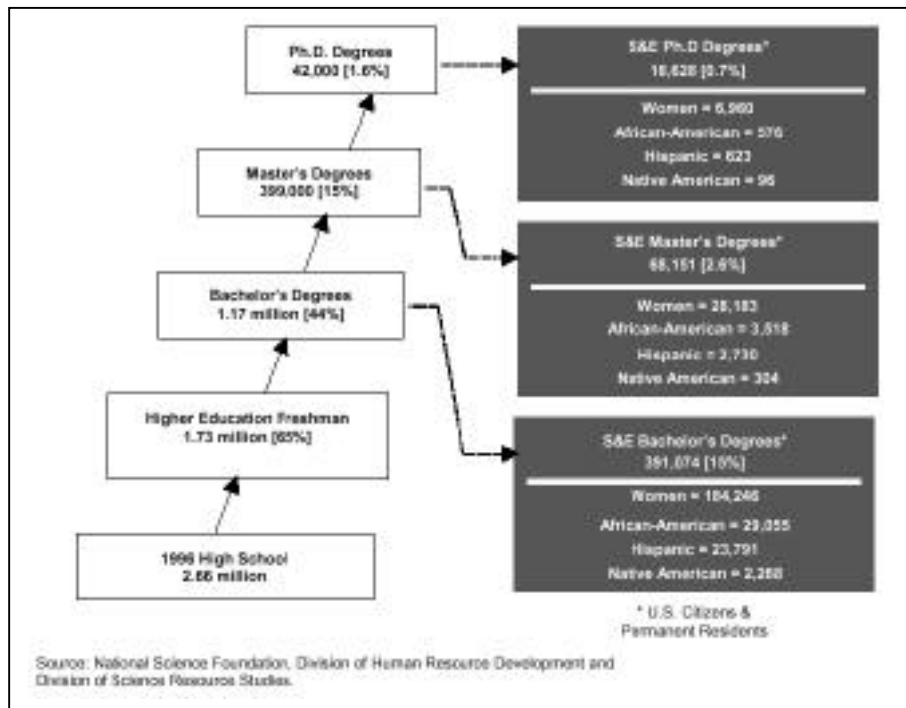


Figure 1. The 1996 graduate productivity of the educational system with projected percentages based on the number of high school graduates.

¹ The National Science Foundation, “Committee on Equal Opportunities in Science and Engineering 1998 Biennial Report to the United States Congress,” November 4, 1999, CEOSE991. <http://www.nsf.gov/cgi-bin/getpub?ceose991>

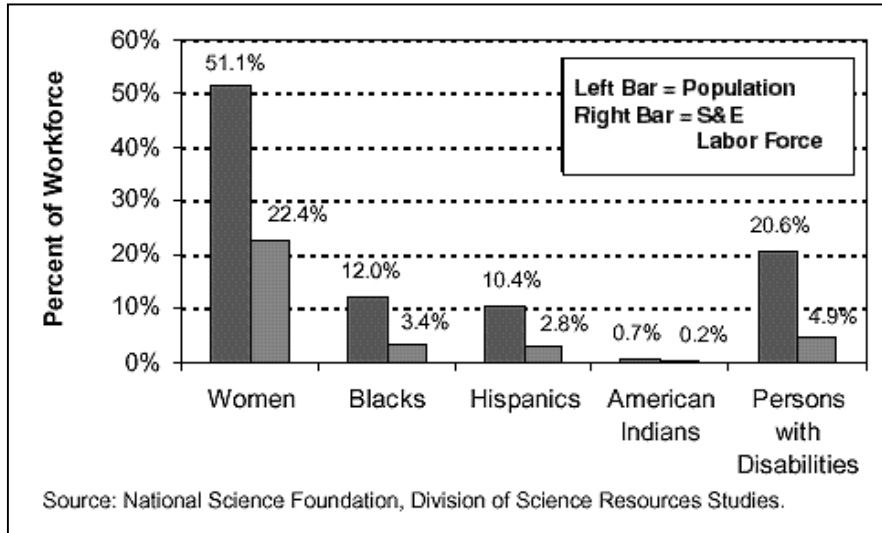


Figure 2. Percentage of Science and Engineering Labor Force and Percentage of Scientists and Engineers in the Labor Force within the U.S. Resident Population, by sex, race/ethnicity, and disability status: 1995.

To address the wide disparity shown in Figures 1 and 2, the attendees shared their experiences, opinions, and perspectives of working technical women; identified avenues for change; and articulated goals for both national policy initiatives and change at the participants' home organizations.

Four national policy recommendations were constructed and concepts for extending success were presented to effectively implement policy.

Four National Policy Recommendations

- Create a web-based central communication and information hub.
- Fund a national informational campaign to fundamentally reshape the image of scientists and engineers and their work.
- Provide a national program to aid the advancement of technical women in the workplace.
- Provide a national model and support for a flexible workplace environment that will aid in attracting and retaining women in technical fields.

Concepts for Extending Success

Creating an environment to support change is key to implementing effective policy.

Therefore, three concepts were presented to support national policy:

- Expand the modes of institutional learning (networking and mentoring);
- Acknowledge adaptive careers to balance work/life throughout a career; and
- Plan for a more diverse workforce by the year 2005 to better connect people to the mission and needs of an organization.

The forum was cosponsored by Lawrence Livermore National Laboratory, Sandia National Laboratories, and the Society of Women Engineers (through a grant from the ExxonMobil Foundation).

Introduction

Strategies Within—Forging New Realities for Women in Science, Engineering, and Technology was a one-day forum held November 10, 1999 in San Ramon, California that brought together 100 women from national laboratories, industry, and universities. The forum was co-sponsored by Lawrence Livermore National Laboratory, Sandia National Laboratories, and the Society of Women Engineers.

The forum was designed to: (1) generate new ideas, best practices, and innovative solutions to attract and retain women in the scientific and technical fields; and (2) submit this information to the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET) via their participation and this report. In addition, the report also includes supporting material in the appendices:

- Appendix A—a summary of the forum program;
- Appendix B—biographies of the panelists, guest speakers and CAWMSET members who attended the forum;
- Appendix C—biographies of the members of the steering committee;
- Appendix D—the list of participants; and
- Appendix E—a description of the CAWMSET.

The forum used an interactive approach to generate solutions, focusing on the participants' experiences in the workplace and characterizing the elements that have contributed to their success. These elements were then synthesized and generalized to create policy recommendations and to describe concepts for extending success that would be broadly applicable in the technical workforce. The forum and this report have led to ongoing discussions among the participants. The general framework of the results is being expanded and adapted to meet the needs of the participants' respective organizations.

Clearly, diversity is an issue which cannot be ignored in this time of high demand for science and technology workers. It is advantageous to employers to have the broadest possible pool of candidates in order to ensure a continual infusion of high-quality employees into their organizations. Thus making an organization inclusive and attractive to a diverse audience will facilitate recruiting efforts. Similarly, each organization makes a large investment in their current employees so retaining these people must also be a high priority. Employees who view themselves as an integral and valued part of their organization will be more committed over the long term. We therefore believe that the recommendations and best practices described herein make good business sense, providing benefits to both the organization and the employees.

A. National Recommendations

1. Central Communication and Information Hub

Create a web-based central communication and information “hub” to aid in building a diverse workforce by providing tools, statistics, and access to candidate and employer information. This hub should provide links to the following information:

1. Workforce recruitment kits;
2. Registry of science and engineering graduates with accompanying statistics;
3. National repository of resumes for scientists and engineers; and
4. National repository of job openings for scientists and engineers.

Unlimited access should be given to the job openings, statistics, and toolkits. Registration can be required for prospective employers seeking resumes.

Much of this information exists but is usually specific to a single technical field, collected by a wide variety of academic and professional organizations, and scattered across numerous locations. This central hub is envisioned to be a single, central point of access to a wide variety of information that cuts across discipline lines.

Specific Elements:

Workforce Recruitment Tool-Kits

Develop a set of toolkits describing specific strategies for more effective recruiting with the goal of constructing a diverse candidate pool. Field-specific toolkits would be developed and placed on the web-based hub for broad access. This would meet the needs expressed by many technical managers of not knowing where to find well-qualified women. A readily applicable template that provides concrete and proven guidance would also be useful in other technical fields as well. The toolkit strategy has been successful at the College of Engineering at the University of Washington [ref: Dr. Denice Denton, Dean of Engineering]. They created a toolkit for department chairs that aids in recruiting and successful hiring of diverse faculty candidates in Engineering.

Registry of Graduates

Create an information resource by requiring universities to complete a web-based exit survey for each graduating student in science and engineering. This information would be anonymous but would include the student’s gender, ethnicity and degree information along with other information suggested by organizations using this data to allow rapid (effectively real-time) compilation of statistics regarding the representation of women and minorities in the pool of available applicants across all scientific and engineering disciplines. Currently these statistics are compiled by the National Science Foundation but

the data collection and analysis takes several years to complete. This delay makes the data less useful for formulating diversity goals and targets. The repository could be centralized and maintained by an existing federal organization such as the National Science Foundation.

**National
Repository of
Resumes**

Create a national resume repository of scientists and engineers in all fields and at all career levels, allowing unlimited access to registered employers. The goal is to create a resource that cuts across technical disciplines rather than being narrowly targeted. In an era of increasingly cross-disciplinary work this expanded scope is essential. Special emphasis will be placed on recruiting women and minorities to get their information in the database. A standard resume form can include a detailed “experience” category where participants can supply keywords to aid in matching them to potential employers. Participants supply information such as gender so employers can consciously build diverse pools of well-qualified candidates. This repository would also include brief profiles of the educational institutions and prior employees represented. Cooperative arrangements might be possible through existing professional societies, such as the Society of Women Engineers, the American Physical Society and others. An example of such an existing resource is the American Institute of Physics employment and industry site at <http://www.aip.org/industry.html> .

**National
Repository of
Job Openings**

Create a national repository of job openings for scientists and engineers in all fields and allow prospective employees unlimited free access. Universities, national laboratories, government agencies and private industry should be actively recruited to participate.

2. National Image Campaign

Develop and fund a national campaign to fundamentally and positively change the image of scientists and engineers and their work. Media portrayals of technical subjects often make scientists seem remote, and make science seem far too difficult for the “average” person. Scientists and engineers are too often portrayed as negative stereotypes. These stereotypes discourage talented young people from entering scientific and technical fields.

**Specific
Elements:**

**“It’s Cool to Be
Smart”
Campaign**

Develop and fund a public service advertising campaign portraying learning as fun and “cool” and fostering the idea that science and technology are for everyone. The campaign should feature a diverse assortment of technical people including women, minorities, and people with disabilities to show that success in technical roles is achievable by all. (Similar to spots on Mentoring and Outreach currently airing on network TV.)

Role Models & Mass Media

Changing the underlying mass media culture can have an enormous influence on children, but can also play an important role in changing workplace cultures. All positive public images are constructive. Therefore to complement more direct efforts, a national policy to encourage cooperative arrangements between science and technology organizations and the mass media can inject positive images in the same way that the anti-smoking campaign injects negative images of smoking.

Real Scientists, Real People

Fund a program to train scientists and engineers to communicate more effectively to non-technical audiences and provide positive role models and examples of the positive impact of their work on everyday life.

3. Flexible Workplace Initiatives

Flexible workplace initiatives include the construction of a national standard for basic, flexible workplace benefits including options for *paid* maternity/paternity/family leave, support for *affordable, universal* childcare, flexible work time, telecommuting, and job sharing. Incentives should be built into this model by providing tax breaks for companies that institute these policies and funding for expansion of existing programs. Workforce flexibility issues make it particularly difficult for women in technical careers to balance work and family. Since technical fields are constantly changing and moving forward, time out from your job can be career-limiting or career-ending. Additionally, many technical women who have partners in technical fields encounter added pressures (e.g., relocation now requires finding two specialized, often scarce positions). The American Physical Society recently published a survey on the “dual career couple” [<http://www.physics.wm.edu/dualcareer.html>], which illuminates why these issues often limit and derail women’s careers more than their partner’s.

Specific Elements:

Paid Leave Program

Provide paid leave for employees facing family issues (maternity, paternity, adoption, elder care). President Clinton’s recent proposal (Dec. 1999) would allow states to use money currently earmarked for unemployment compensation toward this goal. Other viable proposals can involve paid sick leave or private insurance.

National Balancing Act Award

Establish a national awards program to recognize and reward those employers who do an exceptional job of helping employees balance their professional and personal lives. Criteria would include providing family-friendly benefits (paid leave, widely available and/or subsidized child care), supporting flexible workplace components (flex time,

telecommuting, job sharing), or emphasizing the importance of life outside work.

Flexibility Initiative

Fund incentive programs for employers who build flexibility into their workplace including flexible work time options, telecommuting, and job sharing. Establish metrics to measure progress and provide tax breaks to employers who meet these goals.

4. Advancement Initiatives

Advancement initiatives include:

- Supporting advancement for women in the technical workplace by providing public recognition and incentives to employers who have done an outstanding job of advancing capable women at their organization.
- Providing avenues for women to pursue education and training in leadership and management practices to ensure a well-qualified pool is available when opportunities for advancement arise.

Specific Elements:

Recognizing Success

Establish a Presidential “Shattering the Glass Ceiling” Award to recognize organizations that have done an outstanding job of advancing capable women into senior positions. This award must have a high level of prestige to foster competition among technical employers.

Training for Leadership

Provide funding for women to pursue leadership development and management training to help create a critical mass of well-qualified candidates for more senior positions.

Collecting Statistics

Encourage organizations to collect information and statistics on recruitment and retention issues. This should include conducting exit interviews with people departing the organization as well as interviews with candidates who decline job offers. This information can then be used to help formulate new policies to address the issues causing women to either leave or not join the organization. It could also be deposited in the central information hub for use by other organizations. Similarly, if programs are identified as effective (by both the participants and by the organization), this information could also be shared via the hub.

B. Concepts for Extending Success

1. Expanded Modes of Institutional Learning

Accessible, comprehensive communications networks represent expanded modes of institutional learning. Institutional learning includes “learning the ropes”, the politics of fostering women’s careers, and strategies that have worked for others in the organization. Networks and role models are important and there are various avenues to facilitate their creation. Expanded modes of institutional learning include networks, institution-to-institution connections, and new forms of mentoring.

Specific Examples:

Recruiting Women for Senior Positions

Recruiting for senior positions should be seen as a long duration effort. By both building relationships with potential external candidates and assertive, inclusive internal succession planning, a well-qualified pool of candidates will become available for senior positions. Potential hires are first asked to participate on external review boards and speak both formally and informally to key groups at an organization. This gives both the organization and the potential hire a chance to develop a better understanding of each other. Because of the numerous opportunities the best women scientists have, it is particularly important that institutions target them and pursue a proactive recruiting strategy. Senior management at research institutions should seek out the top women scientists at professional meetings and devise strategies to familiarize them with their organizations.

Increasing the number of women in senior positions will shift the attitudes of staff within the organization by reinforcing the idea that promotable and successful women exist. This will improve morale for existing women employees and increase the rate of internal promotions. Having more high visibility women within an organization will also make it more attractive for women to join.

Establish Cross-Institutional Relationships

Organizations should create relationships with each other that cross-pollinate successful concepts, processes, and policies for attraction and retention. This approach maximizes successful implementation in that two organizations agree to share policy details. A more open exchange of information can be fostered because the venue is smaller, as opposed to nationwide.

Bring External, High-Visibility Women into Local Culture

Bringing external, high-visibility women into the local culture demonstrates that successful women exist. This strategy can be implemented often through existing channels such as distinguished lecturer series and participation of women on oversight and review committees. Both the guests and the local institution benefit.

Create Women's Networks and Network Opportunities

Women's symposia or forums, like the Hewlett-Packard's *Technical Women's Symposium* and the *Strategies Within Forum*, provide the opportunity to hear about workplace experiences, to learn from each other's stories, to make connections, and to "recharge." In contrast to one-on-one mentoring, group opportunities offer "mentors" to many and can be used as an additional technique for promoting the advancement of women in science and technology.

Leverage the Time and Experiences of Senior People

The one-to-many approach described above maximizes the connection with the very busy yet "in demand" senior women. It enables dialogue and stimulates new thinking by offering multiple perspectives on relevant issues. The dialogue among many can be richer and more prolific than that between only two individuals.

2. Adaptive Careers

The adaptive career is a dynamic concept that acknowledges the differing needs for achieving work/life balance *throughout* a career. The adaptive career recognizes the possibility that accelerated achievement may occur at different times depending on outside influences. Important features of adaptive careers are:

- Availability of an array of programs (flexible work schedules, part time work, job sharing, telecommuting, sabbaticals);
- Customizable for individuals;
- Negotiated between managers and employees;
- No stigma associated with using these adaptive career programs; and
- Alternative performance metrics for people who use flexible work options.

Specific Examples:

Change Polarity of Approval Decisions

Perception shifts can improve the acceptance of people's use of adaptive career programs. An example of this is to change the requirement of senior management approval for the *use* of a flexible work schedule to the requirement of approval for the *denial* of such a program. This emphasizes the expectation that the line manager and employee will find a mutually acceptable implementation of the policy. An inability to reach agreement on a flexible schedule would be the exception.

Find Valid Productivity Metrics

There exists a widespread belief that the cost of adaptive careers is reduced productivity. There is an enormous need to understand whether or not this belief is true. National initiatives should fund research collaborations between academics and actual work environments. The goal is to determine what productivity metrics apply to full-, flex- *and* part-time employees in a way that is rigorously valid.

**Benefit
Attraction and
Retention**

Incentives for adaptive careers are evident for both employer and employee. The employer benefits by improved retention and a more satisfied workforce. In addition, a company with successful adaptive career programs will find it easier to attract skilled new employees. The employee benefits from an environment that recognizes contributions and supports career growth, while allowing a balanced life.

**Recognize
Accountability**

The accountability for the successful adaptive career rests both with the employee and line manager. They are responsible for negotiating and implementing flexible work schedules to meet both the employer's and employee's needs. Failure to complete this negotiation should require review by senior management—an incentive to make it work.

**Allow Alternate
Career
Timelines**

Alternate timelines recognize that success is achievable at any point in one's career, perhaps as personal priorities have changed. Some employees will focus early on family and accelerate in their careers later, and others will need a time out later for family or aging parent issues. A single standard trajectory for success should not be assumed. The alternate career timeline is a philosophy that can be consciously interjected into an organization, and that will benefit both women and men.

**Use
Recognition
Awards**

Recognition awards can highlight managers and teams with both high achievement and productivity and visible inclusion of adaptive careers.

3. Workplace 2005

Workplace 2005 is a concept of the achievable, better workplace of the near future. The description of this workplace was a significant output of the forum. *Workplace 2005* incorporates the needs of an increasingly diverse workforce, recognizing elements that will better connect the people to the mission and needs of the organization. Improved connection enhances the ability of women to make meaningful contributions to the workplace and be adequately recognized for them.

Workplace 2005 is inclusive, provides ready access to information and policies, guides in learning the ropes, uses performance metrics that reflect true value, has increased representation of women at all levels, and presents opportunities for adaptive careers.

Women's issues in the workplace are frequently institutional ones with a broad applicability to the workforce. Unfortunately the burden is often upon the disadvantaged person to correct a deficiency. Moreover, when that deficiency is a systemic institutional problem, the burden may be overwhelming. Grassroots efforts can only take hold where there is a critical mass of people to push towards change.

Institutional efforts, on the other hand, can systematically address workplace issues and thereby improve productivity for everyone. Therefore, as demonstrated by Hewlett-Packard and other organizations recently, institutional initiatives can have enormous power to effect change.

**Specific
Examples:**

**Require Open
Policies**

Workplace 2005 includes open and understandable policy. Examples of policies with synergy between an equal playing field *and* an effective and productive work environment include:

- Management promotions for management skills and track record;
- Technical promotions for technical accomplishments and skills; and
- Objective, uniform, and well-publicized skill requirements and responsibilities for promotion levels.

**Reward
Managers**

A manager's success at hiring women and at enhancing their careers should figure as an integral part of the performance appraisal process for management.

**Include
Diversity in
Strategic Plans**

Goals for increasing the representation of women in scientific and technical roles, and for enhancing the career path of existing women, should be an integral part of an organization's strategic plan. Benchmarks and metrics should be used to assess the degree to which each organization has met its diversity goals. Increased diversity is a good business decision for a technical organization. Hence it must be integrated into the fabric of the strategic planning process.

Summary

This report is the beginning of a broader discussion. It is expected that the general framework laid out here will be expanded and adapted to meet the needs of specific organizations. This one-day forum focused on creating new strategies to aid in the attraction and retention of women working in technical roles—addressing specific recommendations for national policy and concepts for extending success to initiate changes to increase women’s success in the technical workplace.

Implementing these strategies to attract and retain women will have a positive impact in the workplace and culture of the future—allowing diversity to flourish for a healthier, more dynamic, and successful technical organization.

The four national policy recommendations that were constructed provide a mechanism to move forward in a proactive manner:

- Create a web-based central communication and information hub.
- Fund a national informational campaign to fundamentally reshape the image of scientists and engineers and their work.
- Provide a national program to aid the advancement of technical women in the workplace.
- Provide a national model and support for a flexible workplace environment that will aid in attracting and retaining women in technical fields.

These national policy initiatives provide a mechanism to incorporate diversity naturally into the very framework of technical organizations.

The concepts for extending success provide a mechanism to support these recommendations (i.e., mentoring, acknowledging adaptive careers, and planning for a diverse workforce by year 2005).

A commitment to a diverse workforce must be one of the core values of the institution and the employees must understand and embrace these values as well as see them in action. People must be given access to the tools necessary to achieve positive change. Mandating change without providing necessary support and resources is a recipe for failure. In order to motivate positive change, incentives must be offered for success and, conversely, there must be consequences for poor performance. Accountability is perhaps the single most important component of any successful program. The people in the organization must be committed to and feel responsible for its success.

We intend to capture the energy and ideas from the forum and direct it into local action. Groups at both Sandia and Lawrence Livermore

National Laboratories are developing local implementations of the best practices and policies. No single set of recommendations will fit every organization equally well. The task at hand is to take the overarching goal of an inclusive, supportive, and diverse workplace and devise strategies for our home organizations that will allow us to achieve this in the near future. We challenge other organizations not only to advocate for global, systemic change, but to partner with your management and create local change today.

Appendix A

The Forum Behind the Report

Strategies Within—Forging New Realities for Women in Science, Engineering, and Technology brought together 100 women who work in science, engineering, and technology. Lawrence Livermore and Sandia National Laboratories and the Society of Women Engineers cosponsored this one-day forum, acknowledging an important ownership role for women scientists and engineers to create effective strategies and recommendations for change based on our combined experiences.

CAWMSET The concept for this day began last spring during a brief conversation between women scientists and engineers from Lawrence Livermore and Sandia and Congresswoman Ellen Tauscher. She reaffirmed that our experiences and perspective would provide valuable input to the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET).

Objectives The objectives of the day were to find effective strategies for creating a positive work environment for inclusion in the Commission’s report, for our workplace, and for us; to accept the ownership of effecting this change; and to build new bridges and alliances to make this happen.

Program The morning focused on “Strategies Within” using a story-based approach to identify recurring themes in participants’ successes. The Panel opened by sharing a story from their own careers and, working with the moderator, the audience identified the themes. Then participants worked in pairs to tell about a time of their own success and then in larger groups to extract their themes and generalize.

The middle part of the day brought both a Sandia case study to the audience and the challenges from Commission members and Panelists. A constructive dialogue with the Commission members validated the need for forum recommendations.

The final part of the day “Forging New Realities” engaged the participants in cluster groups to develop input for strategy development. A wide variety of issues were addressed.

At the closing, participants from Sandia and Lawrence Livermore chose to discuss further steps in bringing the strategies and recommendations to our respective management. Several participants committed to a continuation of efforts initiated by the forum.

Next Steps	The forum was captured on flipcharts, video, and audio tapes as well as in the minds of the participants. The Steering Committee issued a report to the Commission in early December. We will also disseminate the recommendations from the forum in briefings to executive management and in open presentation to all interested parties. We are committed to sustaining productive attention to these issues, recommendations, and results through our own efforts and through an ongoing network
Summary	<p>The forum</p> <ul style="list-style-type: none"> • attracted 100 working women in the field of science, engineering and technology; • combined experiences of women from the national laboratories, industry, and universities; • enlisted a panel of distinguished women scientists and engineers; • included the perspectives of three attending Commission members; and • presented new results from Sandia's internal study on technical women promoted to management. <p>The Steering Committee</p> <ul style="list-style-type: none"> • met and talked in advance of the forum with several Commission members; • committed to sending a report to the Commission by December; • engaged our senior management to find ways to work with our issues; and • established a cooperative network between Sandia and Lawrence Livermore National Laboratories.
Participants	Attending were women from Lawrence Livermore (~50), Sandia (~20), Society of Women Engineers, Lawrence Berkeley, SLAC, Los Alamos, NASA, DOE, Bechtel, University of Washington, UC Berkeley, California Department of Transportation, HP, Silicon Graphics, Tandem, and several other Silicon Valley industries.
Vision	The message at the start of the forum: Today we will leave thinking differently and acting differently by reframing our reality, by regaining our passion and power, by refining old tools or rolling out new ones, and, most importantly, by realizing the vast range of our choices.

Appendix B

Brief Biographies of Forum Guests

Nicole Schapiro, Forum Facilitator and Opening Address Speaker

President and Founder of Nicole Schapiro & Associates (NSA), Ms. Schapiro designs and delivers training programs, offers organization development consulting, presents customized solutions for major organizations in the private and public sector, nonprofit agencies, educational institutions and associations both locally and globally. She is the New York Times' best selling author of *Negotiating for Your Life*. As an internationally known Keynote Speaker, Coach and Trainer, Nicole designs and delivers dynamic and practical programs on Team Building, Strategic Planning, Negotiation/Influence Strategies, Marketing and Sales Tactics, Change, Administrative Staff Development, Valuing Diversity, Customer Delight and Executive Leadership. Nicole inspires many individuals to achieve higher productivity and better shape their future. She has received numerous awards such as Toastmaster Internationals Leadership Award and in 1995 was named International Woman of the Year. In 1996 she was nominated for Woman of the Year by KGO Television and was named the San Francisco Small Business Administrations Woman Business Advocate of the Year for 1998. Her degrees include a BS in Psychology, University of Chicago and an MA in Industrial Psychology, New York University.

Anita Borg, Panelist and CAWMSET Member

Anita Borg is President of the Institute for Women and Technology, CA, located at Xerox's Palo Alto Research Center. The Institute for Women and Technology works internationally to increase the impact of women on technology and to increase the positive impact of technology on the world's women. In 1987 she founded Systems, an Internet-based community for women in computing, and in 1994, she co-founded the Grace Hopper Celebration of Women in Computing. Anita Borg is a member of the Women in Technology Hall of Fame, a Fellow of the Association for Computing Machinery, received a 1995 Pioneer Award from the Electronic Frontier Foundation, and has been a member of the Computing Research Association's Board of Directors since 1994. In 1999, she was appointed by President Clinton to CAWMSET. She has a PhD in Computer Science from New York University.

Yvonne Clearwater, Panelist

Yvonne Clearwater has a PhD in Psychology from the University of California, Davis. She is one of NASA's top international authorities on the psychological implications of long duration space flight, and has won many awards for her work. She has evolved through a dramatic career change, and is now applying her skills and experience toward providing television programming to tell the behind the scenes stories about NASA Science and Technology.

Dona Crawford, Panelist

Dona Crawford is the director of the Model Based Design and Manufacturing Integration Program at Sandia National Laboratories, involved in high-performance computing and information technology research and development. She holds a Bachelor's Degree in Mathematics from Redlands University, and a Master's Degree in Operations Research from Stanford University. Dona Crawford also serves on several advisory committees for the National Science Foundation and the National Research Council.

Denice Denton, Panelist

Denice Denton is Dean in the College of Engineering and Professor of Electrical Engineering, at the University of Washington. Her research interests include the use of micromachining systems (MEMS), the plasma deposition of polymers used in photonics applications, and new methods polymers in integrated circuit applications, and new methods for the evaluation and analysis of systemic change in science, math and engineering education. She has a PhD in Electrical Engineering from MIT.

Gail Mattson, Panelist

Gail Mattson is Assistant VP and Operations Manager for Foster Wheeler Environmental Corporation, directing their office in Oak Ridge, Tennessee. She has more than 22 years experience in environmental engineering management of multi-disciplinary project teams and operations management including business development and resource allocation. Ms. Mattson has a BS in Chemistry and Biology, a MSE in Environmental Engineering and is a licensed professional engineer and certified hazardous material manager. She is also the President-elect of the Society of Women Engineers, her term commencing in July 2000.

Claire Max, Panelist

Claire Max is Director of University Relations at LLNL. Her research interests have included laser-plasma interactions, astrophysical plasmas, and most recently adaptive optics and laser guide stars. She has served on many national committees, including the National Academy of Sciences' Committee on International Security and Arms Control, the National Research Council's Commission on the Physical Sciences, Mathematics, and Applications. She holds a PhD in Astrophysical Sciences from Princeton University.

Darlene Solomon, Panelist

Darlene Solomon is R&D Manager in the Chemical and Biological Systems Department of Agilent Technologies (a subsidiary of Hewlett-Packard). Ms. Solomon is responsible for longer-range investigations of new analytical measurement technology for new business expansion. Her business expertise emphasizes Life Science, Bio/Pharmaceutical and Chemical Industries, and technologies include mass spectrometry, microanalytical technologies, and microstructures. She has a PhD in Inorganic Chemistry from MIT. Ms. Solomon has two children, son (1989) and daughter (1992), and a very supportive husband who also has a demanding career.

**Dori Ellis,
Guest Speaker**

Dori Ellis is Director of the International Security Center at Sandia National Laboratories, Albuquerque, New Mexico. Dori Ellis was employed by Sandia National Laboratories in June 1978, and earned a BS and an MS in Mechanical Engineering from the University of New Mexico in 1978 and 1979, respectively. Over her twenty-year career with Sandia, as a staff member and manager she has been responsible for non-nuclear testing of weapons; analytical physics; development of electro-mechanical devices for the military and intelligence communities; strategic planning for nonproliferation (for the DOE); nuclear waste management using deep geologic nuclear waste repositories such as the Waste Isolation Pilot Plant (WIPP) and the Yucca Mountain Project (YMP); the Reactor Engineering Technology Center, and Transportation Surety. The Ellis' have four college-age children, and one daughter still at home. Their home adjoins a golf club, where they frequently play tennis and golf.

**Kathryn
Johnson,
CAWMSET
Vice-Chair**

Kathryn Johnson is the Owner & Principal Consultant for Matrix Consulting Group Inc., Rapid City, SD. Matrix Consulting Group provides services in environmental science and technical communication related to regulatory analysis, waste management, permitting, and remediation of soil and water. Among her clients are the State of Idaho, US Army Corps of Engineers, the Rand Corporation, Shell Oil Company, and Burlington Northern Railroad. Dr. Johnson has over 20 years of environmental consulting. She is a gubernatorial appointee of the South Dakota Board of Minerals and Environment. She won a Bush Leadership Fellowship, which provided her an internship in the White House Office of Science and Technology. She has a PhD from the South Dakota School of Mines and Technology.

**Suzanne
Winters,
CAWMSET
Member**

Suzanne Winters is currently the Executive Director, Escalante Center, UT. She is on a 2-year leave of absence from her position as science advisor to Utah Governor Leavitt and the Utah legislature. As science advisor, she provides insight on matters relating to science and technology and their applications to government, industry, and public issues and is the liaison between the scientific community, both academic and industrial, and state and federal policy makers. Dr. Winters serves on various oversight and advisory committees about scientific research, commercialization of technology, and K-12 education and is adjunct faculty, Department of Bioengineering, University of Utah. Her employment in industry has included president, Membranes and Coatings Consultants, Inc.; senior materials scientist, Symbion, Inc.; project manager and researcher, Battelle Columbus Laboratories, and director of biomaterials and membranes technology, CardioPulmonics, Inc. She has a PhD in Pharmaceutics from the University of Utah.

Appendix C

Brief Biographies of Forum Steering Committee Members

Tina Back Tina Back specializes in x-ray spectroscopy and plasma diagnostics at LLNL. Lead experimentalist in radiation transport/flow research on high energy density plasmas created at the Nova and Omega lasers. Also involved in several University Use experiments on the Nova laser and the mentoring of postdocs and summer students. She holds a BA in Physics from Yale and a PhD in Physics from the Univ. of Florida. She is also an Oakland Teacher Scientist Alliance and EYH participant.

Dorothy Bishop, Forum Co-Chair Dorothy Bishop has a BS/MS Chemistry/Food Technology and 25 years experience as an Environmental Chemist at LLNL emphasizing fate and transport of contaminants in the environment. In her current position as Associate Division Leader, she manages the Program Development Project (establishing, nurturing collaborations, new projects and work for others) and coordinates the R & D part of the Environmental Restoration program.

Regina Bonanno Regina Bonanno is a laser physicist currently serving as LLNL's Assembly and Refurbishment Manager on the National Ignition Facility (NIF) Project. Prior to this she served as Manager for Laser Operations in the Atomic Vapor Laser Isotope Separation Program (AVLIS). Gina received her PhD in Physical Chemistry from the University of Maryland, in 1984. She then spent two years as a National Research Council Post-Doctoral Fellow at the National Institute of Standards and Technology. She joined LLNL in 1986 and led a number of laser development projects within the Laser Directorate. Between 1992 and 1994 she was the Optics Manager for a small company in the optics industry. For the past two years, Gina has been a member of the Laser Directorate's Leadership Development Program. She has been a participant in the Women's Technical and Professional Symposium, the Tri-Valley Science Fair and has given numerous talks for local community groups and high schools.

Kimberly S. Budil Kimberly S. Budil is a design physicist in LLNL's B Division within the Defense and Nuclear Technologies Directorate. She received her BS degree in Physics from University of Illinois at Chicago in 1987 and her MS (1989) and PhD(1994) in Applied Science from University of California, Davis. Prior to her current assignment she was an experimentalist in the High Energy Density Experimental Sciences Program of the Laser Program and performed experiments on the Nova and Omega laser facilities. She co-founded the Women and Science and Engineering (WISE) committee of the LLLWA, was technical co-chair of the Women's Technical and Professional

Symposium in 1998, and has been very active in EYH. She is married and has two young sons.

Kathy Ormiston Cromwell

Kathy Ormiston Cromwell is a congressional liaison at Lawrence Livermore National Laboratory in Livermore, California. She came to the Lab after working fifteen years in Washington, D.C. Her positions in Washington included appropriations aide for Minority Leader Bob Dole, budget analyst for the House Budget Committee under Chairman John Kasich, and Special Assistant to the Director of the Congressional Budget Office. Kathy has a BA in economics from Indiana University and an MA in economics from the University of Maryland.

Evi Dube

Evi Dube has a PhD in Computational Science from UC Davis, and is a Co-Principal Investigator for one of the ASCI Simulation Codes. She has worked at LLNL for over 15 years, and created an opportunity to work in DOE Headquarters ,Washington, D.C.

Carol Gerich

Carol Gerich, BA English; Teaching Certificate; MA English; Specialization in Technical Communication Communications Manager for Engineering; former instructor in Technical Communication for San Jose State University. Responsible for managing (strategic and tactical) all internal and external communications for the Engineering Directorate (about 1/3 of LLNL). Active in LLLWA Scholarship Committee and Diversity Task Force. Frequent speaker at conferences on internal communications.

Monya Lane

Monya Lane is currently Operations Manager for the Engineering Directorate at LLNL, responsible for personnel-related operations, leadership development, education and training, communications and information systems. Since joining LLNL in 1979, she has contributed to a variety of programs, including magnetic fusion energy, laser isotope separation, non-nuclear experiments, ICF target fabrication, environmental restoration, and NIF start-up and operations. Monya holds a BS degree in mechanical engineering from San Jose State University, and is a registered professional engineer in California. She has served on the national Board of Directors for the Society of Women Engineers, was an organizer of the first technical women's symposium at LLNL, and has chaired the local Expanding Your Horizons conference

Jane Ann Lamph, Forum Co-Chair

Jane Ann Lamph leads Sandia National Laboratories program for Demilitarization of Conventional and Chemical Munitions. She and the team are responsible for developing these programs with the DoD as well as interfacing with other DOE National Laboratories and industrial contractors. Her previous assignments include: Department Manager, Engineering and Emerging Technologies, responsible for designing and developing systems for environmental and energy

applications; Manager, Sandia/CA Government Relations Office; Manager, Environmental Test Department; and project engineering responsibilities for a space vehicle and three weapon design programs. She holds BS and MS degrees in Mechanical Engineering and a BS in Business Management. Jane Ann serves on the Board of Directors for UC Berkeley Engineering Alumni Society and Berkeley City Ballet; is a former board member of the Professional and Business Women's Conference (PBWC) and the March of Dimes; served on the executive council for Mt. Diablo ASME; has been active in SWE, the DOE Review of Laboratory Programs for Women, Expanding Your Horizons, and other Education Outreach activities.

Celeste Matarazzo

Celeste Matarazzo, BS Computer Science and Mathematics. LLLWA Advancement and Solutions Committee Co-Chair. Past LLLWA President. Project Leader/Technical Lead for ASCI Scientific Data Management Effort. Computer scientist leading a team developing tools and computer infrastructure that will enable Lab scientists to more effectively utilize and analyze the enormous amount of computed and experimental data available to them. Active in Expanding Your Horizons.

Nancy Monson

Nancy Monson has over 10 years of experience in organization and leadership development. Currently, Nancy works as an internal organization development consultant for Lawrence Livermore National Laboratory. Prior to Livermore, Nancy was a manager for Andersen Consulting's Change Management practice where she specialized in large-scale organization change. Nancy worked at Livermore previously in a wide variety of roles, including leadership development, 7 Habits of Highly Effective People facilitation, team effectiveness, institutional planning, and computer programming. Nancy also has worked as an independent consultant for organizations such as The Sierra Club, Haas School of Business, Brown and Toland, and the Bernard Osher Foundation. Nancy holds an MBA from UC Berkeley, an MA in the Science of Creative Intelligence, and a BS in Applied Mathematics. She is also an avid cyclist, backpacker, and mountaineer.

Tristan M. Pico, Forum Co-Chair

Tristan M. Pico is an Environmental Engineer at Lawrence Livermore National Laboratory (LLNL) who supports the Environmental Restoration Program. She received her BS with Honors in Civil and Environmental Engineering from the University of California, Davis in 1995. Tristan has been employed by LLNL for ten years and currently works on remediation of chlorinated solvents in coarse- and fine-grained sediments and ground water. In addition, she serves as President of the LLNL Women's Association (LLLWA), Section Representative for the Mt. Diablo Section of the Society of Women Engineers (SWE), and Commissioner on the Alameda County Status of Women Commission.

Mary Clare Stoddard

Mary Clare Stoddard, BS Mechanical Engineering, Tuskegee; MS Mechanical Engineering, Purdue. Past chair of the Sandia Women's Committee. Project manager for supercritical water oxidation pilot plant for the US Army at Pine Bluff Arsenal, Arkansas. SCWO is an alternative to incineration for demilitarization of obsolete munitions. New assignment: program manager for Sandia's Distributed Information Systems Laboratory (DISL), new facility for creating and implementing advanced information technology across nuclear weapon complex.

Lori Turpin

Lori Turpin, BS Human Relations & Organizational Behavior, University of San Francisco; MBA Management, Golden Gate University. Lori's 23 year career at LLNL has included 14 years in the field of Information Systems Management. A computer systems analyst by training, with experience as a group and project leader, she is currently Deputy Associate Director for Planning, Development & Personnel in the Chemistry Materials Science Directorate. She has been active in community service groups and career development for young women through the program "Expanding Your Horizons in Math and Science" since 1982 and was the conference chair in 1991. She was a key contributor to the 1992 DOE Review of Laboratory Programs for Women held here and at Sandia Livermore. She also was a presenter in the 1993 LLNL Women's Technical Symposium, and a Program chair in 1998. Lori was the president of LLNL Women's Association in 1994. She was a founding member of the EYH Consortium, and is currently a Livermore Rotarian.

Erica von Holtz

Erica von Holtz is currently the Deputy Division Leader for Operations in the Chemistry & Chemical Engineering Division. During her 15 years at LLNL, she has worked on a wide variety of applied research projects, including Enhanced Surveillance, Molten Salt Oxidation of Mixed Waste, and Paste Extrudable Explosives. She has chaired LLNL's High Explosives Safety Committee, managed the Women's Issues Program for its first 3 years, and co-chaired the Diversity Action Team for Opportunity. Erica received a BS in Chemical Engineering from RPI, and an MS in Engineering - Applied Science from UC Davis.

Rosemary Walling

Rosemary Walling, Physicist. Test Manager for PEREGRINE, a 3D Monte Carlo Radiation Treatment Planning System. Active in organizing local Expanding Your Horizons Conferences and efforts centered around creating awareness and opportunities for women in technical fields. Program Chair 1996 LLNL Women's Technical and Professional Symposium. LLNL Women's Association Advancement & Solutions Committee Co-Chair. Previous research includes applications of laser-plasma interactions, x-ray lasers, 100-fs lasers. PhD Applied Science, UC Davis; MS Physics, Boston University.

Appendix D

List of Participants

Allendorf, Sarah	SNL	Gerich, Carol A.	LLNL
Back, Tina	LLNL	Golder-Novoselsky, Elina	LLNL
Baisden, Trish	LLNL	Gonzalez, Don	LLNL
Barrett, Kelly A.	LLNL	Gordon, Susanna	SNL
Berge, Patricia A.	LLNL	Gross, Mary	US DOE
Bersie, Joan	SNL	Hansen, Luisa	LLNL
Bishop, Dorothy J.	LLNL	Happel, Anne M.	LLNL
Bishop, Janice L.	NASA/Ames Research Center	Hartmann Siantar, Christine	LLNL
Bonanno, Regina E.	LLNL	Hawke, Joanne	LLNL
Borg, Anita	Xerox Corporation	Holman, Mary Anne	LLNL
Brunish, Wendee M.	LANL	Houghton, Susan M.	LLNL
Budil, Kimberly S.	LLNL	Hruby, Jill	SNL
Cam-Winget, Nancy	Intrinsic Graphics	Hughes, Kathryn	SNL
Campbell, Barbara	LLNL	Johnson, Kathryn O.	Matrix Consulting Group
Carlsen, Tina M.	LLNL	Kammeraad, Judy	LLNL
Chang, Rosemary E.		Kane, Staci	LLNL
Clearwater, Yvonne	NASA/Ames Research Center	Kashgarian, Michael	LLNL
Clifford, Eileen	SNL	Kataoka, Dawn	SNL
Clingingsmith, Debbie	Hewlett-Packard	Kinnard, Carol	The Sphere Information Services
Cook, Andrea	LLNL/CAMS	Kolda, Tammy	SNL
Crawford, Dona	SNL	Lamph, Jane Ann	SNL
Cromwell, Kathy Ormiston	LLNL	Lane, Monya A.	LLNL
Daily, Lara	LLNL	Larson, Trish	SNL
Davis, Linda	Contra Costa Newspapers	Lytle, Cynthia J.	LLNL
Denton, Denice	University of Washington	Mabery, Shalini	LLNL
Dignon, Jane	LLNL	MacLachlan, Anne J.	UC, Berkeley
Dube, Evi	LLNL	Matarazzo, Celeste M.	LLNL
Edwards, Donna	SNL	Mattson, Gail G.	Foster Wheeler Environmental Corp.
Ellis, Dori	SNL	Max, Claire E.	LLNL
Falcone, Patricia	SNL	May, Sarita Holland	LLNL
Fant, Karen	SLAC	McBride, Jacqueline	LLNL
Fields, Susan	US DOE	Minichino, Camille	LLNL
Frederick, Mary	California Dept. of Transportation	Monaco, Suzanne	LLNL
Fruetel, Julie	SNL	Monson, Nancy L.	LLNL
Garcia, Nancy	SNL	Montano, Gloria	SWE
Gates-Anderson, Dianne D.	LLNL	Morrow, Valerie	LLNL
		Ng, Dorothy S.	LLNL

Noonan, Kathleen A.	LLNL	Stoddard, Mary Clare	SNL
Owens, Carolyn	LLNL	Stoner, Susan L.	LLNL
Pennington, Deanna M.	LLNL	Tam, Bessie B.	Dames & Moore
Pico, Tristan M.	LLNL	Tejada, Judy	SNL
Powell, Lynne H.	Bechtel	Tse, May K.	Silicon Graphics
Ramirez, Angela	Staff, Hon. Ellen Tauscher	Tung, Louann Schwager	LLNL
Reed, Harry	LBNL	Turpin, Lori S.	LLNL
Roe, Natalie	LBNL	Valle, Lorie	LLNL
Schahin-Reed, Dorreyah	LLNL	von Holtz, Erica	LLNL
Schapiro, Nicole	Nicole Schapiro & Associates	Walling, Rosemary S.	LLNL
Schuld, Joni M.	LLNL	Wechsler, Dawn	DOE
Scott, Karen	SNL	Winbush, Merlinda	SNL
Smith, Tommy E., Jr.	LLNL	Winters, Suzanne	Escalante Center
Solomon, Darlene S.	Agilent Technologies	Winters, Joan M.	SLAC
Spencer, Cherrill M.	SLAC	Wong, Carla	NASA
Spengler, Sylvia	LBNL	Yobs, Donna	LifeScan, Inc

Acronyms

LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
SLAC	Stanford Linear Accelerator Center
SNL	Sandia National Laboratories

Appendix E

Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET)²

The Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET) was established by Congress on October 14, 1998, to research and recommend ways to improve the recruitment, retention, and representation of women, minorities, and persons with disabilities in science, engineering and technology education and employment.

Its early exploration of the advancement of women, racial and ethnic minorities, and persons with disabilities in science, engineering, and technology (SET) has convinced the Commission that the Nation has an urgent economic and social imperative to ensure that U.S. citizens who are members of these groups have full participation at all levels of SET education and in the SET work force.

Drawn from information received during its public hearings and other resources, the Commission's final report to the President, members of the Congress, and the 50 governors will focus on effective strategies that address this imperative, are national in scope, have significant impact, support systemic change, and can begin to be implemented immediately.

Vision Statement

CAWMSET envisions a society that:

- Enables access to and achievement in quality education and training in science, mathematics, engineering, and technology for all Americans;
- Fosters a diverse, well-trained, and globally-oriented work force exemplified by innovation and productivity; and
- Is committed to optimum utilization of all U.S. intellectual capital in order to maintain U.S. technological leadership, global competitiveness, and quality of life in the 21st century.

Mission Statement

The mission of the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development Act (Public Law 105-255, approved October 14, 1998) is to recommend a specific set of actions that will:

- Advance the full and equitable participation of all Americans in SET education;
- Increase the number of qualified American scientists, engineers, and technicians by expanding the human resources pool of women, members of racial and ethnic minority groups, and persons with disabilities; and

² This information was taken from the CAWMSET web site at <http://www.nsf.gov/od/cawmset/start.htm>

- Thereby enhance the Nation's economic capacity and technological growth in this era of global competitiveness.

The recommendations will be directed toward policies and programs that can be implemented by the Congress, federal departments and agencies, state governments, private enterprise, nonprofit organizations, and education institutions.

**Commission
Membership**

The Commission is composed of 11 members, who serve for the life of the Commission.

Ms. Molly H. Bordonaro
Associate, Norris, Beggs, and Simpson

Dr. Anita Borg
President & Founding Director, Institute for Women and Technology,
Xerox PARC

Dr. George Campbell Jr.
Liaison to the Committee on Equal Opportunities in Science and
Engineering (CEOSE)
President & CEO, NACME, Inc.

Dr. Mary Ellen Duncan
President, Howard Community College, Maryland

Ms. Judy Linskey Johnson
Manufacturing Manager for Assembly & Test, Vickers, Inc.

Dr. Kathryn O. Johnson
Vice-Chair, CAWMSET
Owner & Principal Consultant, Johnson Environmental Concepts

Dr. Rowena G. Matthews
Chair, Biophysics Research Division, University of Michigan

Ms. Elaine M. Mendoza
Chair, CAWMSET
President & CEO, Conceptual Mindworks, Inc.

Dr. Jill T. Sideman
Director and Vice President, CH2M HILL Companies, Ltd.

Dr. Suzanne Winters
Executive Director, Escalante Center

Mr. Charles E. Vela
Sr. Science Advisor, IIT Research Institute
Exec. Director, Cntr. for the Adv. of Hispanics in Sci. & Eng. Educ.