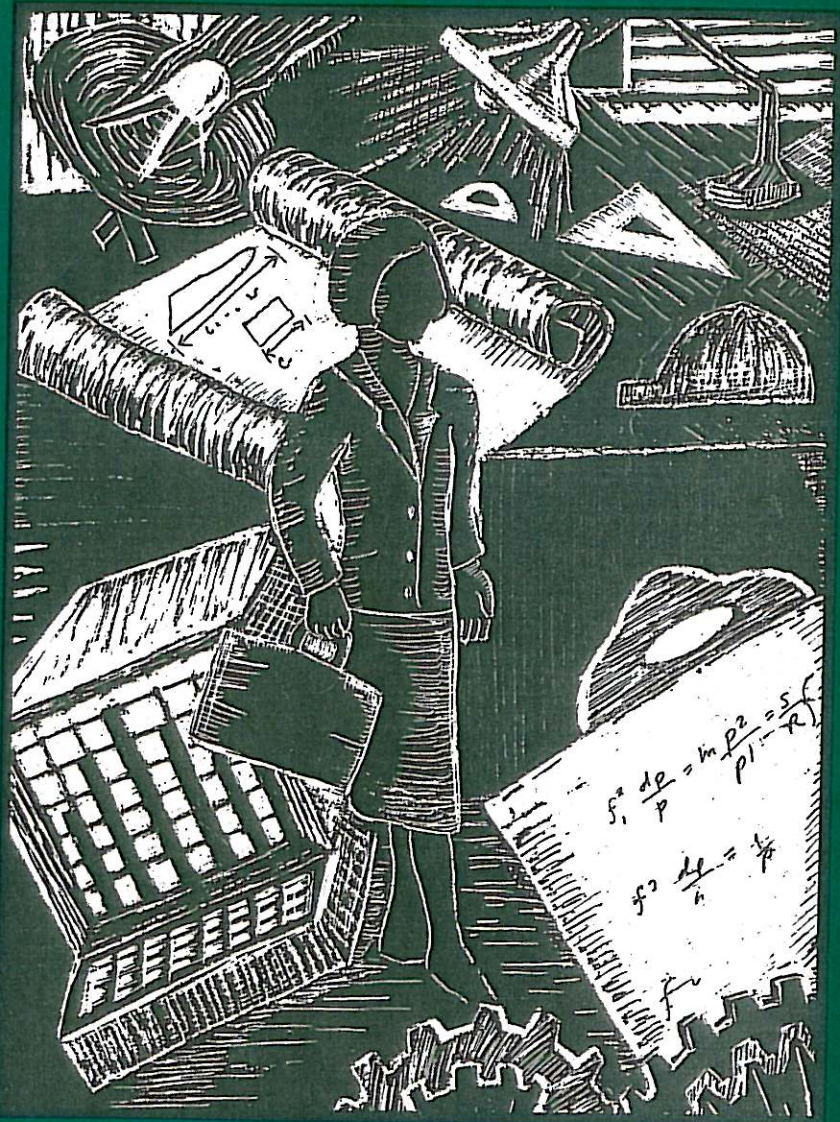


catalyst

## Women in Engineering: An Untapped Resource



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*This research was funded by AT&T Foundation, 3M Company, Motorola, Texaco Foundation and Westinghouse Foundation. Additional funding was provided by BASF Corporation.*

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# *Introduction*

Despite spectacular career advances in the past three decades, female engineers still represent a very small minority — just eight percent — of the engineering work force. (Bureau of Labor Statistics, Current Population Survey). Literature and surveys predating Catalyst's study of women in engineering suggest the existence of factors, such as sexual harassment and lack of role models, which contribute to women's low representation. Clearly, in an era of intense marketplace competition, when the country's competitive edge is ever more dependent on innovation and technology, engineering companies cannot afford to underutilize or jeopardize any source of available talent.

When Catalyst began its research on women in engineering, statistics from national data-collecting institutions indicated a projected shortfall of engineers in the next decade. While subsequent research revealed little consensus on the "manpower" demands in engineering, it is important to consider several substantiated predictions:

- The demand for professionals with engineering backgrounds will increase in the service producing sector (Bureau of Labor Statistics, Occupational Outlook Quarterly);
- The field of engineering is projected as one of the five areas that will account for two-thirds of growth in service companies (Fowler);
- Employment in engineering and engineering management services is expected to grow from 2.5 million in 1990 to 3.8 million in 2005. (Bureau of Labor Statistics, Occupational Outlook Quarterly).

At the same time, dramatic changes are predicted in the demographics of America's college-age population segment (age 16-24), from which new engineering students and engineers will emerge. While the size of this segment in the year 2005 (24 million) is expected to be slightly greater than a similar segment in 1975 (23 million), the mix will include higher percentages of women and minorities and lower percentages of white men (Bureau of

Labor Statistics, Occupational Outlook Quarterly). It is interesting to note early evidence of this: In 1990, women received 11.7 percent of the engineering doctorates conferred on U.S. citizens and permanent residents, up from 4.8 percent in 1980 (National Science Foundation, Selected Data). In the same year, women represented 17.7 percent of all full-time, first-year engineering students, reflecting the highest enrollment ever (Shinberg).

These statistics and projected demographic shifts hold tremendous implications not only for the recruitment and education of new engineers but also for the way the environment will need to change to respond to a work force in which engineers of any sex or race/ethnicity can function in the most productive way.

The purpose of Catalyst's study of women in engineering was to examine obstacles to women's recruitment, advancement and retention; to identify factors known to contribute to the success of female engineers; and to uncover progressive corporate policies or practices that help make the engineering environment more hospitable for women. Ultimately, our aim is to show that the obstacles to women's productivity and advancement are indeed remediable and to give companies the knowledge and inspiration to improve the engineering environment.

## *Overview of Findings*

The female engineer encounters roadblocks from her earliest school days. Sociological studies have documented how factors in early childhood and elementary/high school education have cumulatively discouraged many young women from exploring these disciplines (Girls, Inc., Wellesley College). As a result, the message is that only the very few brightest need apply. In addition, the engineering and other scientific and mathematical disciplines have historically been organized and taught by men; this often leads to a lack of acceptance of women's ideas within these fields (Brush, McCarthy, Rosser).

In its study, Catalyst has observed the way these roadblocks affect female engineers. Because we have chosen to concentrate our research on the development and advancement of those already in the work force, the important question of how to attract more women into the engineering field is not directly addressed. However, the study will have an impact on recruitment in the sense that satisfied and accomplished female engineers are the best

indication of opportunities and possibilities for young women considering a field of study. It should also be noted that we have confined our study to the corporate workplace, where Catalyst has developed substantial expertise through previous research projects and advisory interactions.

Catalyst researchers found that female engineers enjoy their work and express pride in their accomplishments, despite numerous obstacles and often less-than-congenial working conditions. These obstacles are detailed in this report, along with strategies for removing them and examples of corporate policies and programs that have been instituted to overcome these obstacles. Following is a summary of some of the major obstacles female engineers face:

#### **DILEMMA OF BEING A WOMAN AND AN ENGINEER**

The corporate engineering culture is male-oriented, with intense pressure to conform to "masculine" styles and deny issues of concern to women. In this environment, a competent and confident woman is likely to be considered "too aggressive." Female engineers' comfort in the workplace can also be undermined by inappropriate behavior of male colleagues, including sexual harassment.

#### **A CALCULATED RISK**

Due to the small number of female engineers at any given company or facility, male managers' experience in evaluating women's capabilities is limited; thus, promotions of women tend to be approached with extreme caution or even fear. Therefore, women are promoted only after they have repeatedly proven that they can perform the tasks required in the new position, whereas men are promoted based on their potential.

#### **PATERNALISTIC ATTITUDES**

Some engineering positions, particularly those in manufacturing plants, utilities and at field sites, have unusual or round-the-clock schedules, heavy travel demands and are perceived to be "dirty." Often there are presumptions that these work environments are inappropriate for women due to the nature of the work or women's family obligations. In order to protect them from this environment, women are often not given these critical assignments, thereby depriving them of necessary experience for career advancement. However, many female engineers have successfully demonstrated their ability to

manage work and family demands. In addition, they continue to express the desire to work on manufacturing or "rough" projects to gain valuable experience.

#### **ABSENCE OF ROLE MODELS**

Positive role models, often male relatives, have played an important part in attracting women to the engineering field. However, as female engineers move into middle and upper levels within their companies, they find very few women who have reached these levels and who can serve as their role models or mentors.

#### **LACK OF OPPORTUNITIES FOR PROFESSIONAL CONTACT**

Female engineers' exclusion from the "old boy network" is not unlike that of other professions. However, the small number of women in engineering accentuates the impact of such exclusion and leads to a feeling of isolation. More importantly, few other opportunities exist for women to learn informally across ranks and divisions. Further, there appears to be little support for formal women's networks within the workplace.

Most of the barriers encountered by female engineers are not unique to the engineering workplace; indeed, Catalyst researchers have found them to exist in many organizations. However, the small numbers of women in any given engineering company or at a specific work site tend to make these obstacles more severe and pervasive.

The economic situation and structural changes in corporate America have affected the career advancement of both women and men. However, the country needs to continue to develop female engineers in greater numbers and at higher levels of responsibility to the point where they have sufficient "critical mass." Only then will their concerns be regarded as "mainstream," and only then will women be given the support necessary to fully develop their talents and become more productive employees.

# *Background*

## *About Catalyst*

Catalyst is the national not-for-profit organization that works with business to effect change for women through research, advisory services and communication. Catalyst activities target the *Fortune 500* and *Service 500* corporate community with a focus on management and professional women. The staff works with senior management and human resources professionals to integrate women into every level of management. Through interaction with the corporate community and research on emerging business issues pertaining to women, Catalyst helps companies not only to understand but to anticipate the needs of their work force.

Catalyst works with companies at the early stages of policy development and provides them with publications, research reports and advisory counsel. Because the organization does not depend on consulting fees, it is able to pursue its research independently and to report and interpret both its findings and its recommendations objectively.

## *A Historical Perspective*

Before 1960, few women entered the field of engineering through formal study. Nevertheless, they made significant contributions to many inventions such as those that revolutionized cotton and grain processing. With some of the earliest inventions, ownership of patents was often granted to male relatives or colleagues; for example, Catherine Greene, a female associate of Eli Whitney, is believed to be largely responsible for the invention of the



cotton gin. Notable among female inventors was Harriet Strong, "Mother of the Colorado Project," who patented a series of improvements for dam design and reservoir construction in 1887 (Minnesota Historical Society).

During World War II, the first women were recruited into the field of engineering to fill in for male draftees who had been working in aircraft construction (Capece). In the past three decades, women have advanced many corporate initiatives in science and engineering — in 1965, Stephanie Kwolek of E.I. du Pont de Nemours & Company patented Kevlar, a substance used to strengthen oil rig cable and bullet-resistant padding; in 1980, Barbara J. Bruschi of Eastman Kodak Company patented Ektachem, used to determine urea nitrogen and cholesterol content in blood; and in 1982, Miriam F. Young of Honeywell patented Semiconductor Device Processing, developed as part of the Strategic Defense Initiative (Minnesota Historical Society).

*Women in the  
Engineering Work  
Force*

In 1991, nearly 190,000 women worked in a professional or technical capacity in the engineering field (Bureau of Labor Statistics). The significant progress women have made over the past three decades can be seen by the percentage of engineering degrees awarded to women at various academic levels.

**PERCENTAGE OF ENGINEERING DEGREES  
FROM U.S. INSTITUTIONS AWARDED TO  
WOMEN**

	<b>Bachelor's Degree</b>	<b>Master's Degree</b>	<b>Doctorate</b>
1960	0.4%	0.4%	0.4%
1970	0.8	1.1	0.4
1980	9.7	6.3	3.2
1990	15.4	14.3	9.1

(Engineering Manpower Commission)

This pattern of educational achievement means that nearly 80 percent of female engineers have been in the work force 10 years or less, as shown in the following chart. Clearly, they represent a wealth of untapped talent.

<b>Percent of Female Engineers</b>	<b>Years of Experience</b>
40%	5 or less
38	6 to 10
17	11 to 15
5	16 or more

Interestingly, women obtained doctorates in engineering in 1986 in about the same proportion as they earned bachelor's degrees in 1978, possibly indicating a high rate of continuation to graduate studies (Hornig).

### *Previous Studies of Female Engineers*

The 1989 Cooper Union survey of members of the Society of Women Engineers (SWE) found that a large majority chose the profession because they wanted to do interesting work, they liked the challenge of solving problems, and they expected to earn a good salary. These women reported high levels of career satisfaction, but at the same time, they pointed out some serious gender-related concerns. They felt they had to work harder than male engineers and, even though their salaries were generally comparable to men doing the same work, promotions did not come at a comparable rate. Socially, they felt alone or isolated; professionally, they felt their ideas, suggestions or complaints were not taken as seriously as those of male engineers, and many felt excluded from decisionmaking. In particular, non-white female engineers reported that they felt under more scrutiny than their white female counterparts. Further, many of the female engineers believed they would be penalized if they took maternity leave, and many reported that they had been subjected to sexual harassment.

In examining differences between men and women in engineering, SWE's own 1991 pilot survey elaborated on the issues identified in the above study. While both sexes chose the engineering profession for many of the same reasons, women were more likely to do so because they excelled in mathematics and science, and were more likely to be looking for good salary

prospects and challenging work. In analyzing responses from male and female engineers in age-matched groups, the SWE study concluded that experienced women were less positive about their work than experienced men and that the women at higher levels were generally less satisfied with their employers. The more experienced female engineers reported lower levels of career satisfaction than their male counterparts over a range of issues, covering job content, personal challenge, training and advancement opportunities, salary, support facilities and equitable treatment.

The differential salary patterns for male and female engineers is especially interesting. In 1990, the mean salary for female engineers of all ages was \$46,000, compared with \$52,000 for male engineers of all ages (*EE Times*). However, the SWE study showed that the youngest women were comparable to or ahead of their male counterparts in compensation, while the older women lagged behind. The crossover in salaries tends to occur around age 30, and the compensation differential increases with career progression, both in terms of experience and education (National Science Foundation, 1986 Biennial NSF Report on Women; LeBold and Lindin). Significantly, the crossover appears to occur at a time when a typical engineer would have had six to eight years of work experience and is poised to assume a management position; this is also the time when many women begin to leave the work force temporarily to have children.

## *Research Methods*

In Catalyst's study, qualitative research methods were used to collect information from human resources managers, working engineers and engineering supervisors of 30 corporations. Though the study focused on female engineers, male engineers and supervisors were included in the research to gain a broader understanding of the engineering environment and to allow comparisons of their perceptions and experiences with those of their female counterparts. Findings represent a consensus or pattern of beliefs and opinions among participants. The verbatim statements presented within the text are intended to illustrate or elaborate on participants' viewpoints. The overall analysis was derived from the entire transcript of the focus group and interview discussions explained below.

Catalyst's study corroborated many of the issues detailed in the survey results of the previously discussed Cooper Union and SWE studies. However, this study's qualitative research goes beyond survey data by adding color, meaning and nuance to the findings, allowing for a richer perspective and the development of more realistic recommendations.

The research consisted of four phases and was conducted over an eleven-month period from February 1991 to December 1991.

### *Phase I*

Corporations that employ a large number of engineers were identified, and their human resources professionals were invited to participate in roundtable discussions held at Catalyst's offices. Representatives from 20 corporations shared with Catalyst their experiences with the recruitment, development and retention of female engineers. Information gathered in this phase was used in guiding the design of Phases II and III.

### *Phase II*

Fifteen female focus groups and three male focus groups, involving 166 engineers, were conducted at 14 different corporations. In one company, there were focus groups at two separate sites and in three companies, there was a male focus group as well as a female focus group. These discussions took place from March through September 1991.

The focus groups generally consisted of eight to twelve people and lasted for one and a half to two hours. Each focus group used a structured discussion guide; however, since focus groups are a flexible research method with established parameters, question sequence and the amount of time allocated to each topic varied according to responses from the participants.

### *Phase III*

A total of 50 individual interviews were conducted with engineering supervisors at 17 corporations. Most of the interviews were conducted in person, while a few were conducted over the telephone. They ranged in length from 45 minutes to an hour, and the discussions were guided by a questionnaire that covered the same topics as the discussion guide used in Phase II focus groups. These topics included:

- Recruitment into the engineering field and the company;
- Factors important for career advancement as an engineer;

- Success factors for female engineers in the organization;
- Functions/areas in engineering in which advancement has been more difficult for women;
- Working relationships with peers, subordinates and supervisors;
- Travel and relocation;
- Sexual harassment and other issues of special concern to female engineers;
- Retention;
- Advice to women entering the field of engineering.

## *Phase IV*

Three day-long strategy sessions in November and December 1991 at Catalyst were attended by the human resources managers who had taken part in the initial set of roundtable discussions, as well as managers from those companies that participated in Phases II and III, and a representative from the Society of Women Engineers.

Catalyst presented preliminary research results, and corporate participants recommended strategies that have proven successful in recruiting and developing female engineers.

## *Company Profiles*

Only companies that employ a large number of engineers were invited to participate in the research. These corporations reflected a range of industries and employed engineers in a wide variety of specializations. They included industrial companies in the aerospace/defense industry, in the petroleum, chemical, consumer products and high technology industries, and public utilities. The companies ranged in size from 4,500 to 300,000 employees.

Focus groups and interviews were conducted at work sites in different parts of the country — in the Northeast (Massachusetts, Connecticut, New York, New Jersey), the South (Louisiana, Florida, Tennessee), the Southwest (Texas), the Midwest (Illinois, Michigan, Minnesota) and the West (California).

The diversity in industry type and work locations allowed for the inclusion of engineers employed in a wide variety of settings — chemical and utility plants that operate 24 hours a day, off-shore oil rigs, high technology research laboratories that are quite similar to academic environments, and manufacturing units with production facilities in other countries.

In this diverse group of companies and work settings, Catalyst found substantial variation in the extent to which proactive steps have been taken to recruit, develop and enhance career opportunities for female engineers. Although the sample was diverse, it cannot be considered a systematic, scientific sample of U.S. corporations. Therefore, the results reported in this study are not “representative” in a scientific sense of the experiences of female engineers employed in corporate settings. Nor can they purport to “represent” the experiences of female engineers in small organizations, consulting firms or within particular engineering sectors and disciplines.

## *Participant Profiles*

Participating companies determined which male and female engineers would be included in the focus group discussions and which engineering “supervisors” would be interviewed. In some companies, the female supervisors selected did not have responsibilities equivalent to those of their male counterparts, but they were the most senior women available in those companies.

## PARTICIPANT PROFILES

	Focus Group Participants		Interviewees	
	Male	Female	Male	Female
Actual Number	29	127	10	38
<b>EDUCATION</b>				
Have graduate degree (percent)	59	44	90	67
<b>AGE</b>				
Average	35	32	42	36
Range	25 - 58	25 - 56	32 - 54	26 - 51
<b>SALARY</b>				
Average	\$61,600	\$47,777	\$97,000	\$68,158
Range	\$40,000 - \$70,000	\$30,000- \$80,000	\$60,000- \$250,000	\$40,000- \$130,000
<b>TENURE</b>				
Average (years)	8.0	6.5	13.0	9.0
Range (years)	1.5 - 14	0.5 - 35	2.5 - 35	0.5 - 23
<b>MARITAL STATUS (percent)</b>				
Single	17	29	—	10
Married	83	61	100	74
Divorced	—	10	—	16
<b>HAVE CHILDREN (percent)</b>				
	69	33	80	55

The above chart summarizes characteristics of the research participants.

## **EDUCATION**

A large percentage of the engineers held graduate degrees, and an even larger percentage of the supervisors of both genders held such degrees. Noteworthy is the fact that a much greater percentage of the men at both levels had advanced degrees.

## **AGE**

On the average, the women were slightly younger than the men, even though their age ranges did not differ substantially.

## **SALARY**

The women had average salaries substantially lower than the men at both the working and supervisory levels. Both the averages and ranges seem to indicate that some of the female supervisors were compensated at about the same levels as the male non-supervisors. This may be due to the fact that some of the "supervisors" interviewed may not have actually functioned in such capacities; it may also be due to the small number of participants.

## **TENURE**

The male engineers had slightly more work experience at their companies than their female counterparts. Not surprisingly, the male supervisors had substantially more work experience than the female supervisors.

## **MARITAL STATUS**

The majority of both male and female participants were married. Interestingly, none of the male participants were divorced while several of the female participants were.

## **CHILDREN**

At both the working and supervisory levels, a much higher percentage of the men than women had children. This large difference may suggest that it is easier for male engineers to have both a career and children than it is for their female counterparts.

*Note: The above characteristics apply solely to the research participants. They should not be interpreted as representative of engineers at large.*



# Findings

## Enthusiasm

“These are just toys that are phenomenal ... this is so cool.”

*female engineer*

The female engineers and female engineering supervisors expressed a high level of enthusiasm for their work. Like their male counterparts, they love the challenge and the problem solving. They talk about their passion for engineering even as they discuss the difficult experiences they have encountered and the often less-than-congenial working conditions they must endure. These feelings are illustrated by quotes from two female engineers:

*“It’s something you get a real passion for and most women that I know are just incredibly enthusiastic about what they’re doing.”*

*“It’s so exciting. You want to be part [of it] ... it’s something you can’t even touch, it’s nontangible but ... that’s what makes you come to work every day.”*

Seldom has Catalyst encountered professional women who talk about the content of their work with such passion. A female engineering supervisor spoke for many of the women when she said:

*“I love the technical aspects of making a product work. Being involved right from the beginning, and I love designing a product and just seeing it go from somebody’s thought to actually being ... now we can make that work with the actual material... nuts, bolts, screws together, and make it a reality.”*

In addition, some expressed excitement about being at the forefront of a movement and being in a field that is relatively new for women; they vividly described how being in the engineering field had been extremely invigorating for them. As one female engineer said:

*"I just kind of feel like we all have that challenge inside of ourselves; that extra motivation, ambition for something higher. We're trying to be the first ones making it."*

When asked what advice they would give to a woman just entering the field, both male and female engineers were overwhelmingly positive and encouraging, with many using the expression "Go for it." They would offer the same advice to a woman just entering the field as they would to a man, including the need to work hard and develop good communication skills.

Both male and female engineers expressed confidence that as more and more women enter the field and with the passage of time, difficulties currently encountered by female engineers would diminish and barriers to their advancement would be eradicated. Nevertheless, many of the women felt the encouragement offered to new female engineers should be accompanied by the advice to be aware of the corporate engineering work environment and the "submerged rocks" in the paths of their development. As one female aerospace engineer put it:

*"I would tell them, 'If you want to advance in the engineering field, you'll have to work harder than most males.' ... I think they ought to know that up front."*

*"It's going to be an incredible occupation for women in five or ten years ... there'll be no barriers."<sup>99</sup>  
female supervisor*

It appears that management does not often recognize that women as well as men can pursue careers in engineering with real determination. By the time female engineers enter the work force, they have already made the conscious decision to pursue a career in a field overwhelmingly dominated by men. In the engineering classrooms, they have survived as a small minority in a less-than-supportive environment. Upon graduation, they are ready to go to work and demonstrate the technical skills they have learned.

In entering corporations after graduation, female engineers find that the playing field is not level for them. Their enthusiasm, therefore, is often diminished by the barriers they encounter and the lack of training and role models to help them navigate the challenges of being a female engineer.

## *Barriers to Advancement*

### *Exclusion From the "Old Boy" Network*

Female engineers often find it difficult to break through the old boy network, the informal communication network that is important for advancement. Golf games and other informal networking opportunities provide male engineers with opportunities to socialize across ranks and divisions; they also enable them to learn about work-related matters and how to succeed professionally. Women feel excluded from these cliques and are frustrated and uncertain about whether they should attempt to infiltrate them or circumvent them. Some female engineers interviewed felt they should try to learn how to play golf, because, although there are no formal meetings on golf courses, golf represents an activity during which people get to know each other. However, most women expressed concern about the way the old boy network operates, and would like to see it dismantled entirely. As this is unlikely to happen, a more realistic goal would be to make the network more inclusive of women.

“Because I’ve chosen to be involved in corporate teams, I’m even more visible than I was. I think that has made a difference in my career.”  
*female supervisor*

Exclusion from the old boy network is not uncommon in other professions; indeed, Catalyst has found this to be a problem in many *Fortune 500/Service 500* companies. However, because there are so few women in engineering, the impact of being excluded from informal networks is more damaging. There appear to be few other opportunities for female engineers to learn informally across ranks or divisions, and because there are so few women in upper management, networking among women between levels is difficult. Catalyst did learn that some women use exercise as a way to network with other women. At a company gym, for example, women may attend aerobics classes, and networking occurs in the women’s locker rooms. Other women jog together in the mornings, offering support and advice in an informal atmosphere.

There has been a general lack of corporate support for formalized women’s networks within the corporation. Women have attempted to organize support groups at some companies, but these are usually general women’s groups and not specific to engineers. Some women are hesitant to join even informal support groups for fear that they will be identified as advocates for a single issue, as a human resources professional points out in the following quote:

*"Our women's professional network is taboo—you don't get involved. It's not an organization that within the female ranks they feel comfortable participating in because it is perceived by middle management as being issues-oriented."*

Interdepartmental team projects and task forces are important and non-threatening ways in which women can increase their professional contact. Both are important for visibility and networking. Supervisors are usually responsible for identifying individuals for these special projects. Senior managers need to ensure that supervisors identify qualified women for these opportunities.

### *Hard Work Versus Effective Networking*

Networking allows engineers and managers to learn about work-related matters, in addition to the all-important rules of how to play the corporate "game" in order to succeed professionally. The professional contacts an engineer develops through networking allow the engineer to perform his or her work better by enabling the engineer to utilize resources throughout the company. The larger the network, the more resources the engineer has to draw upon and the easier it becomes to get the job done.

Because most engineers are men, male engineers generally have a much easier time than female engineers in developing a network of professional contacts. Unfortunately, there is a lack of awareness among women of the vital role networking plays in helping to maximize job performance, in addition to self-promotion and career advancement. Moreover, the discomfort men have networking with women can preclude cross-gender networking. Rather than trying to seek guidance through networks, women may try to compensate for this disadvantage by working harder to prove themselves.

*"Women have to do twice as much as men to get recognition for what they are doing."*

*female supervisor*

Research participants noted that young female engineers encounter a great deal of intimidation when assigned to a new project, providing an additional reason for women to feel pressure to prove themselves. Many women are reluctant to ask for assistance or advice on their projects due to a need to prove their own abilities, and out of fear that they will be judged incompetent should they ask for guidance. These women believe that by working hard and independently, they will be recognized and promoted. Instead, women need to be educated early in their careers in the importance of networks in helping them obtain needed advice, recognition and advancement.

## Perception of Need for Physical Strength

“...Hands-on work with hardware, [there is a belief] that women engineers are not perceived as good at that or don't want to do that. It may be changing, some have hands-on and are doing very well.”  
*male supervisor*

“Manufacturing is a tough job. You are working with real heavy machinery... Being out in the shop setting, dirty and greasy, particularly getting clothes dirty, that kind of thing. I don't know if that really appeals to many women.”  
*male supervisor*

While the perception still exists that engineering requires physical strength, the human resources professionals interviewed acknowledged that heavy physical work is no longer a requirement of hands-on line experience, as demonstrated by the following quote from a female supervisor:

*“There's an issue, for example, with some of the female mechanics that they can't do certain jobs because they can't do it physically. The reality is, there are very few of those physical jobs because we are a technology company. We're talking about pulling wire, doing orbital welding. None of those things require physical strength, they require stamina, expertise, but not physical strength. Yet there's still a perception it's a job women couldn't do.”*

Female engineers felt that male managers thought women could not handle the physical nature of the work on the manufacturing floor. As a result, women felt that men restricted them from working on the floor. On the other hand, many men felt that the female engineers were intimidated by the physical nature of the plant environment. Though many of the men felt it was important for women to gain manufacturing experience and “get dirty” in order to advance, some of the male engineers and managers clearly felt that women themselves were choosing not to work on the manufacturing floor. Whether initiated by women or by men, women's exclusion from hands-on manufacturing experience often keeps them from obtaining crucial line positions that are necessary for advancement. Instead, women are often routed into staff positions, such as government relations or public affairs.

As one human resources representative noted:

*“I think there is a subtle tendency to put women in more staff kind of projects. Projects that are maybe more off to the side, may not involve getting into the plant in the middle of the night and really dealing with the operation because of climbing up a tower and getting all dirty. There are perceptions that they either wouldn't want to do that or they couldn't handle themselves in the plant. I hear a lot of women say 'If only I was asked I would give so much to be on a project like that, one that is visible.'”*

Many men and women believe that female engineers are not offered certain assignments because of the paternalism or protectiveness of some male managers, and because men do not feel comfortable with women working in such an environment. These include assignments in which women have to “get dirty” or work with heavy machinery. Verbal abuse directed at women on the manufacturing floor was also cited by male engineers as a reason why

women would not want plant experience or why the assignments are not offered to female engineers. Because the male engineers and managers see few women engineers on the plant floor, they assume women do not want to work in this environment. Moreover, women who are often outside of the informal networks and without mentors are not informed of these opportunities when they do arise.

Both human resources professionals and female engineers reported that women want these valuable hands-on manufacturing experiences. Female engineers noted the importance of such experience in developing a broad understanding of the business and enhancing their career opportunities. However, due to the existing perceptions, women are often passed over when decisionmakers consider engineers for plant projects.

### *Perceived Risk of Promoting Women*

There is a strong sense within the engineering environment that women are promoted to fill quotas. The subject of promotions for female engineers was discussed by male and female managers as being politically difficult. In some cases, this may lead women to doubt their own capabilities. For example, a male manager told of the difficulty he had in promoting a highly capable engineer who was uncomfortable with advancing; she was afraid that she might be perceived as a "token."

*"One female engineer that I thought very highly of was afraid to advance. She felt that she was being set up for failure and people would say she only got up to the next level because she is a female... I told her you can't think that way. You have to think that you received that position because you are qualified."*

*"When people are thinking of who they'll promote, whether consciously or subconsciously, a picture of a white male pops into their minds and that's their definition of what a manager should look like."*

*female manager*

Yet, another male manager noted that men who are not identified as high potential resent female engineers who are on the "fast track." Several female managers believed that they were seen by male engineers to have been promoted solely because they were women, and in fact some male engineers expressed their feeling that reverse discrimination did occur.

Another phenomenon that hinders women's advancement is the risk associated with promoting women. Due to the small number of female engineers at any given company or facility, male managers' experience in evaluating women's capabilities is limited; thus, promotions of women tend to be approached with extreme caution or even fear. Both the human resources professionals and female managers observed discrepancies in how

women and men were chosen for promotions. Promotions of men were viewed as growth opportunities because men were chosen based on their potential. However, when women were picked for promotions, this was considered a calculated risk because each woman's success was so carefully scrutinized. Supervisors reported that a woman must demonstrate her ability before she is promoted so that the risk is lessened.

As one human resources professional explained:

*"I think if we put someone who we don't think is totally groomed for the position into that position, if it is a white male we call it a growth experience. If it's a woman [we] call it a calculated risk."*

The result is that many women are "overripe" for promotion.

*"My boss is somewhat uncomfortable with me because I am a woman at a high level. He has told me so."*

*female supervisor*

Due to the reluctance to promote women, many human resources professionals have found through data tracking that women and minorities stay in their positions longer and are promoted less frequently than white men. Female engineers repeatedly observed that men advance at faster rates. Many of the women believed that this occurred due to the greater comfort level male managers felt with their male subordinates. The female engineers, however, felt that women who had reached higher-level positions had done so due to their own capabilities and hard work.

Once women were promoted, many female supervisors felt that women still did not receive the support they needed in order to succeed due to resistance on the part of some male managers. A female manager stated that her promotion was not accompanied by any support: "I was set up, given an opportunity, but no help. If I didn't know how to network, I would have fallen on my face." Other female engineers believed that some promotions were set up to fail. One focus group of female engineers surmised that there are few women in senior management because a greater number of approvals (usually from men) are needed for promotions at higher levels. The stress accompanying promotion is sometimes compounded for women because many of them feel that if they fail, it would represent failure for all female engineers in the organization.

## *Desire for Role Models*

“The number one thing women need is role models...I've got one woman who worked for me who was really amazed at another woman that works here, and she latched onto her. It really made a big impact on what she's going to do now.”

*male engineer*

“...When we got together and formed a women's group, we really believed that we were taking a career risk, but we felt it was so important that... we chose to take that risk.”

*female supervisor*

Female engineers and managers expressed a strong desire for female role models. Role models were defined as female engineers who had advanced on the management or technical track and were considered to be major contributors within the corporation. While these role models may not act as personal mentors or even be accessible, they do serve as beacons for more junior female engineers and managers. Such role models are in short supply. Both female engineers and managers felt that this shortage of higher-level women served as evidence of the “glass ceiling” women face.

Though senior female engineers and managers of engineers want to be recognized for their achievements as individuals rather than as women, they are nonetheless perceived as role models because of their gender. Junior women identify with senior women engineers as having succeeded despite considerable barriers. Role models are considered important because, as one female engineer stated, when other women have paved the way and established credibility, the women who follow in their path are relieved of the frustration of continuously having to prove that women are capable. Thus, female role models are the frontrunners who help build credibility and achieve acceptance for female engineers at lower levels.

The relatively small number of women who have attained senior management status causes any setbacks they experience to be much more visible. As a result, the pressure to excel is intense for senior female engineers and managers. Because there are so few women at senior levels, those who have “made it” are often perceived as tokens rather than as accomplished individuals, and their achievements can be downplayed by their male peers. Therefore, wide acknowledgement of women's achievements and strong top management support are needed to increase the image of senior women as positive role models and to provide encouragement to junior women about the opportunities that exist for them.

Managers reported that without senior women to readily identify as role models, it was difficult to attract entry-level female recruits. Both female and male supervisors participating in the research suggested that a woman considering a company for her first position in engineering should look at the number of women at various levels and functional areas of engineering, and ask about the company's commitment to the advancement of female engineers. Often, the absence of female interviewers in the recruiting process



demonstrates a lack of role models for young female recruits. Recruits are known to request meetings with the more senior female engineers when interviewing with a company.

Senior female engineers and managers who recognize their role-model status and have actively expressed concern about the utilization of female engineers' talents face the danger of being identified as "single issue" women. In one such case, women assigned to a special issue committee were afraid to speak out for fear that they would be perceived as more committed to underlying issues of gender than to company concerns. This fear is especially common when there is an absence of management support for those issues that are specifically women's issues. Senior female engineers at some companies were also afraid to form corporate women's networking groups because they felt that these groups would be perceived as being "single issue" groups that did not cover business topics. As one human resources professional explained:

*"We found it is not only women, it is also with our minority issues committee — a lot of fear that suddenly if I stand out now... [it's going to seem as though] that's all I'm interested in and that's all I'm capable of doing. Suddenly that's going to be my job, versus commitment to the product I'm making, because I'm fighting for other underlying issues."*

## *Dilemmas*

*"If you adapt to a white male model and succeed that's fine. If you want to succeed but retain individualism, then that's a problem."*

*female engineer*

### **BEING A WOMAN AND BEING AN ENGINEER**

Female engineers receive mixed messages concerning what is appropriate behavior and the image they should project. In some cases women reported that appearing feminine is a liability due to the engineering culture, which is described as both "macho" and male dominated. Many of the female engineers in the study expressed mixed feelings about demonstrating signs of femininity. For instance, one female manager admitted to feeling discomfort in bringing flowers to the office, while another found that by bringing home-baked cookies to the plant, she was able to create a stronger working relationship with her subordinates. When asked how female engineers can best function in a male-dominated culture, many male and female managers said that the best method is to "be yourself" and "have confidence in your own capabilities." As one human resources professional noted:

*"The good old boy culture is probably the key area that I see. The system in a male-dominated industry is set up around men, and even the language favors men. Women have to play a game on top of a game, so they not only have to understand organizational dynamics,*

*but have to understand how to make the transition into a male organizational dynamic. How to look sort of like a man, but not really like a man, because if you get too close to that you get too threatening, and if you get too far away you are not a contender. So I see those cultural issues are perhaps the biggest barriers."*

"Being yourself" for female engineers is not simple. Style of dress is one of the more puzzling issues for the corporate female engineer. Female managers often have to bring in a change of clothes on certain days in order to adhere to appropriate attire for both the plant environment and attendance at corporate meetings. Anecdotes were relayed about the stress that senior male managers in one corporation put on female managers to adhere to an accepted style of feminine appearance.

### **PERCEPTIONS OF STYLES AND ABILITIES**

Women receive conflicting messages on the types of behavior and work styles that are necessary for advancement. For instance, many women and men mentioned aggressiveness and assertiveness as important attributes for career advancement. However, women who displayed "aggressive" behavior were perceived negatively by men. This was stated by both men and women who agreed that it was harder for women to advance because the styles looked upon favorably in men were not seen as attractive in women. They felt that men expected female engineers to demonstrate such stereotypical male attributes as aggressiveness and technical competence yet, at the same time, were threatened when seeing them in women.

Some human resources professionals felt that successful female engineers and managers in the lower ranks were helped by their aggressiveness, but as they climbed the ladder, this was no longer advantageous when it came to interacting with senior management, or for further career advancement. One female supervisor explained her male manager's stereotypes:

*"My boss wanted me to mentor two or three of the women supervisors in his organization who are more junior than I am. They are first level supervisors. And the reason he wanted me to mentor them is because he had what I think is a preconceived notion that they had unique problems because they were women, and I disagree with that. To be specific, he said that two or three of them came on a bit too strong, a bit too domineering with the people they worked with."*

Female engineers and managers felt that while aggressiveness among women damaged relationships with senior management, men's more aggressive behavior led to much better relationships with senior management.

There were mixed perceptions about female managers' management style and whether they exhibited the people skills that are important for career advancement as a manager. In some instances, women were characterized as possessing the positive skills and attributes associated with being an effective manager, such as the ability to communicate, deal with people and be sensitive to their individual differences. Other stereotyped skills attributed to women were creativity, a cerebral, detail-oriented approach to technical problems and presentation skills. However, some participants said that women did not have the skills needed to be an effective manager.

Thus, it was apparent that women must deal with a double-edged sword, since an authoritative style of management is viewed negatively in women, and can even be detrimental to a female managers' advancement. Yet, a more humanistic and participatory style of management from female managers is not respected by male engineers who are used to male managers delegating work and leaving them to "get on with it."

Women must adopt a management style that fits within very narrow confines due to men's discomfort in working under the supervision of a more authoritative woman. Some female engineers and managers advised women to smile a lot because men were uncomfortable around them (one woman even used the word "terrified"). Yet, men are not held to these strange and often conflicting expectations, and are therefore allowed much more flexibility in developing their own personal management style.

Women's emotional responses to stressful situations were found to be another liability in "getting the job done." A few women reported that they occasionally felt like crying at work due to stressful or frustrating experiences; moreover, they felt forced to hide their frustration from their male peers. Men, however, were perceived to be free to vent frustration through such typically male responses as shouting. One female engineer noted this double standard: "When a woman shows stress on the factory floor, the perception is that she can't take it. With men, there is more understanding. 'Oh, he is under a lot of pressure,' people will say."

Some male managers were reluctant to provide negative feedback to female subordinates for fear of a tearful response. Managers' demeaning tone or comments may have caused such a response in some cases. But it is important to note that a reluctance to provide constructive criticism could lead to growing performance problems of which a woman may be unaware, and which could be remedied if brought to her attention.

“People build their expectations on the basis of experience, and they come to these environments where there are ninety men and one woman, and they immediately think that I am the one who brings papers or takes coats.”  
*female engineer*

#### **PERFORMING INAPPROPRIATE DUTIES**

Several male and female engineers commented that female engineers were sometimes asked to perform administrative work, such as copying or typing, that was inappropriate for someone at their rank. Both women and men noted that male engineers were not typically asked to do this type of work. Women noted that sometimes people of either gender automatically assumed that they were secretaries, rather than engineers. A female engineer recalled one occasion during which someone calling on the phone requested that he be connected with one of the engineers in the department, altogether eliminating the possibility that she was an engineer. Another female engineer said that when she was asked to type, she purposely took her time and did a poor job, so that she would no longer be asked to perform secretarial or administrative duties. Some of the women also mentioned that people automatically approached them to request supplies because they assumed that as women, they had responsibility for these functions. Such assumptions send demeaning signals to women.

#### **TECHNICAL VERSUS MANAGERIAL CAREER TRACKS**

Within the engineering field, there are two different career tracks: technical and managerial. Traditionally, financial rewards, more varied opportunities and prestige have been associated with the managerial track and not with the technical track. However, with recent downsizing and cutting of layers of management, the technical track is becoming increasingly important, as illustrated by the following quote from a female engineer:

*“I think, because of the new climate out in the real world, where it's difficult to get the contracts, and they're going to be doing away with more and more overhead, that people will start to see that it's really engineers who do the work and that's really where the rewards should be, and you should stay in that area.”*

Many of the human resources representatives interviewed felt that their companies are beginning to recognize that their survival depends on the competence of their technical engineers, and in the future the technical ladder will be viewed as having greater prestige. As a result, companies are attempting to expand their technical ladder to encourage both women and men to remain on that path instead of shifting to the managerial track.

Even with downsizing, one female engineer said:

*"Let's face it, the way you get promotions and make money is to go into management. They're trying to change that, but they've been very unsuccessful."*

*"Once you've proven yourself on the technical side it's easier. On the management side you have to keep proving yourself, and on the management side it's hard to recover from a mistake if you're a woman... but if you see male managers make mistakes it's considered understandable."*  
*female supervisor*

Women seem to encounter many problems advancing on either the technical or the managerial track. Concern was expressed that there were too few females who were advancing to higher rungs of the managerial ladder, and human resources professionals acknowledged that it is more difficult for women to advance on the managerial side due to misperceptions and stereotypes about women's management style and capabilities: As one human resources professional said:

*"We have no trouble hiring, getting people to have incredible performance reviews in the technical ranks — but our organization sees females and minorities as being capable at engineering and technical work but not as managers yet."*

Women's careers have been far more limited than men's due to the general lack of opportunities on the technical side and the obstacles and barriers they encounter on the managerial track. In order to advance on the technical side, an advanced technical degree is essential. Thus, the pool of qualified women becomes even more limited due to the smaller number of women who hold an advanced technical degree. Further, due to the small number of women within any given company or plant, male managers have very limited experience in evaluating women's managerial capabilities and technical skills and are therefore reluctant to promote them. Consequently, women are experiencing difficulty advancing to senior levels in all areas of engineering. The current elimination of managerial layers has also led to fewer opportunities within management and is of serious concern for women.

“We’ve also had a lot of our female engineers decline promotional opportunities. When you speak to them very confidentially, they say, ‘I knew that my supervisor would have been intolerant of my need for some flexibility because I’m in my life cycle years where I have a lot of child care responsibilities.’”

*human resources  
professional*

## WORK AND FAMILY BALANCE

As is true for many working women (and increasingly for men), issues concerning work and family balance were found to be of paramount concern to female engineers. All of the research participants, regardless of level or gender, felt that their organizations could be much more responsive to employees’ needs in accommodating family responsibilities. Participants suggested that such policies and benefits as extended parental leaves, part-time work options, on-site child care facilities and greater scheduling flexibility were needed. Participants also felt their organizations would reap great benefits by offering such policies, since they would encourage loyalty and improve morale among employees, who would see tangible proof that their companies were helping them balance their professional and personal lives.

Since there are so few women in the field of engineering, companies with an engineering focus may be slower than those in other industry sectors have been in responding to employees’ work and family needs and in adopting the programs and policies that would enhance their work life. Many companies have not felt either inspired or compelled to implement work and family policies, since they have not been faced with requests to do so. Nevertheless, employees and supervisors of engineering companies clearly want options, as the following quotes indicate. A male engineer noted:

*“Policies here are not nearly flexible enough to make it easy for women and almost impossible for men to go away for six months or a year and then come back. It’s as ungenerous a policy as you could hope for.”*

And a female supervisor provided the following insight:

*“If companies look at the resources that they have in trained employees, it makes more sense for them to be flexible about part-time work than to force people to make a choice. That’s what happens here. Job-sharing is not allowed and there’s no part-time work. So you’re either working full-time or you’re not working at all. They also don’t give extended leaves of absence, which is unfortunate.”*

## MOTHERHOOD

In overt as well as subtle ways, women are discouraged to take on greater responsibility once they have children. Human resources professionals felt that if female engineers were discouraged due to the unsupportive

“Motherhood is going to be the biggest issue because we’re expected to be on call 365 days a year, 24 hours a day, and life still has it that usually females are the primary caretakers...”

*female supervisor*

“Travel was the one item I worried about the most when I accepted this position here, but it’s one of the things that I’ve enjoyed the most... It’s difficult because I have two small children, but on the other hand travelling is exciting...”

*female supervisor*

“The thing I don’t understand is that work and family policies build loyalty and they’re a bargain. They don’t cost that much and you build enthusiasm in your employees...”

*male engineer*

environment or lack of advancement, they might be more inclined to leave the organization in order to spend more time with their family. They also noted that women are often passed over for career opportunities due to the perception that their family obligations would prevent them from accepting a new assignment.

A majority of women discussed the process of taking maternity leave. They felt that maternity was not treated as a natural process, and it damaged their careers. As one female engineer noted:

*“It’s like culture shock for these guys. First, it’s me down there. Now you have two pregnant women down there and it’s just amazing that people are starting to realize that it’s not a man’s world and that there are women managers who can take leave, have babies, come back, and just have careers.”*

In some cases, managers openly discouraged women from returning to work after maternity leave. Women also expressed the desire to take extended leaves, and expressed negative feelings toward companies that did not offer such options. Many female engineers pointed out that managers assume that women will not return to work, or will not travel or relocate once they have children. However, the participants pointed out that although travel was more difficult due to family obligations, many of the participants said they continued to travel for business after having children.

## RELOCATION

Relocation was another issue that was discussed in relationship to work and family issues. Many participants, particularly supervisors, mentioned that relocation becomes increasingly important at higher levels in the organization. However, as is true for working couples in general, relocation may prove difficult for dual-career engineering couples in which both partners are pursuing rapid career advancement. This issue is particularly pertinent since many of the female engineers interviewed were married to other engineers, some within the same company. Most of the women mentioned the difficulty of balancing two careers with family responsibilities, and some of the male participants acknowledged that dual-career issues are becoming germane for them as well. The women and human resources managers also discussed the assumptions managers make about women’s ability to relocate due to a husband’s job and/or family obligations. As one female engineer explained:

*"I know that both my supervisor and my husband's supervisor assumed that because we're dual-career, that neither one of us wanted to leave Texas. We both had to straighten them out [to get] good opportunities for both of us."*

Moreover, women are often not offered opportunities overseas due to assumptions that women won't relocate to certain areas of the world because they will not be accepted as professionals.

#### **FLEXIBLE WORK ARRANGEMENTS**

*"I think adaptation can be made in the jobs for all young parents, and there's just this machismo that says we're not going to do it."*

*female supervisor*

In general, women and men acknowledged that part-time options were not available for engineers. Human resources professionals explained that these options were not viable because many managers were resistant to adopting them. At one company, a part-time policy had been instituted for engineers. The participants thought this policy was crucial in terms of retaining women and allowing them to continue their careers while caring for a family. In fact, Catalyst's 1989 study of flexible work arrangements at the managerial and professional levels showed that in 68 percent of participating companies, flexible work arrangements had a positive impact on retention.

The round-the-clock schedules in a manufacturing environment also present difficulties for handling family responsibilities. In this environment, there are often demands on employees' time due to requirements that extend beyond the nine-to-five day. Sometimes production runs 24 hours a day. "Graveyard" shifts and call-outs in the middle of the night are not uncommon. Meeting these demands is crucial in terms of demonstrating commitment to the job and company; however, it becomes very difficult to meet these demands once an employee has children, as explained by a human resources professional:

*"It requires a lot of hours. The engines will finally fire up at eleven at night and you've been there since seven in the morning and you've got to be there and see it and figure out what to do about it and report the next morning to management. That's where heroes are made and that's kind of conflicting with family requirements."*

Companies should ensure that women receive critical experience early in their careers, when they are less likely to have families and more likely to have flexibility. However, even being single and working long hours does not always demonstrate commitment by a woman, as evidenced by this quote from a female engineer:



*"Even though a young female is willing to put in, say, more than eight hours a day, they don't trust that that's going to happen in the future, especially if she's single and doesn't have any other obligation."*

Though manufacturing jobs may not lend themselves easily to more flexible hours or part-time work, participants did acknowledge that some manufacturing jobs could be performed on a part-time schedule.

## *Sexual Harassment*

Sexual harassment, in its verbal or psychological form, plays a significant role in the engineering culture in both plant and office settings. Particularly due to the presence of blue-collar workers in the plant environment, human resources professionals described engineering as a macho, male-dominated culture. Because of women's minority status in engineering, female engineers have learned to tolerate verbal comments that devalue women. As one female engineer noted:

*"Women engineers become tough skinned. How many times have you been in a room of 50 people and have been the only woman? Often times that happens. And if you got upset over every subtle comment that was made you would drive yourself insane... Whereas someone in another discipline, someone who is used to working in pools of mostly women would be offended. A lot of times you just ignore a lot of what goes on because you are in that environment and you get used to it."*

## *The Plant Environment*

It is important to recognize that both male and female engineers felt that the plant environment was a difficult place to work for either gender. However, because men perceive the plant environment as hostile, they have a tendency to want to "shield" and "protect" female engineers from this environment. Many women felt that they were therefore kept from unpleasant but rewarding situations that would greatly benefit both their knowledge of the business and their own career development. Some female engineers also felt that women were not offered plant experience due to concern that a woman's presence would distract plant employees and disrupt work efficiency. As one female engineer explained:

“These poor men think they are protecting us from unpleasant situations. And we don't really want to be protected from these situations. You want to learn from them. If it was miserable down there I would have spoken up and gotten some help.”

*female engineer*

“The shop used to have all these very vivid calendars in their cubicles... It bothers me that it is there because it makes me feel like I am less of a person and they are looking at women more as an object than a human being. But it isn't the kind of thing that you can make an issue of because there are too many other things that are too important.”

*female engineer*

*“When I got my official badge I thought this is it. I'm an engineer, I'm going to be treated as one...I wanted to work on the floor...I wanted to work with the hourly people as they build and learn the whole product. What happened was they gave me an upstairs [position]... I found out from another supervisor why I didn't get the job. He said he thought the men were animals on the floor and being a first year engineer, being single and young...that all the men would not work as efficiently...”*

Thus, the *potential* for harassment that men see in the plant environment may actually serve as a barrier that keeps women from obtaining certain key positions.

Women who gained experience on the plant floor noted that at times plant workers were actually more lenient with them due to their gender. Male engineers, however, had a very different perspective. They felt that women did not want manufacturing and production experience because of the potential for harassment, and that women intentionally shied away from such positions. The small number of female engineers working on the manufacturing floor served to reinforce this perception. Therefore, many male engineers felt that it was the women who placed limitations on their own career advancement by refusing assignments at plant sites. The following quote from a male engineer illustrates this point:

*“Manufacturing is not as prestigious. It's a little more dirty, more hands-on. It's an area women don't want to get into. You are out there with machinery, you are out there with machinists ...and you are going to deal with people who are upset with a lot of issues, and who will be cussing and personally abusing you and that's the nature of the job.”*

Offensive visual materials also devalued women engineers' position in the plant environment. “Pin-up” calendars and posters, though becoming less prevalent with the increased presence of female workers on production and manufacturing sites, demonstrate that women are not thought of as colleagues and peers, but as sex objects. Companies that fail to censure men (including managers) who display these visual materials need to know that they inhibit the development of productive working relationships between male and female engineers. Indeed, women felt that their roles as engineers and supervisors were undermined by the existence of such pictures. In addition, such materials contribute to “an intimidating, hostile or offensive work environment,” leaving a company highly vulnerable to charges of sexual harassment.

## *Business Travel*

*“We are sending a young female out into the very traditional areas of chemicals, fibers, automotive. We are thrusting them out [into the] good old boy network, and they are out there with a customer whom we tend to treat as god, who is making passes at them.”*  
*human resources professional*

Other corrosive forms of sexual harassment that are often much more debilitating involve colleagues or superiors. Women are particularly vulnerable to unprofessional behavior during business travel with male associates. Incidents reported by participants in this research were by no means pervasive, but when they did occur, management's lack of concern served to reinforce the perception of an unfriendly and unsupportive environment for women. In one such instance, sexual harassment occurred when a male engineer gave uninvited neck rubs to a female associate though she repeatedly asked him not to. In addition, he tried to change hotel room arrangements in order to share a room with her. This man was later promoted, even though his inappropriate behavior continued and was repeatedly reported to the human resources department by a number of female engineers. After going out for dinner with her manager during an overseas business trip, another female engineer noted that the manager brought a prostitute with them in the taxicab back to the hotel.

Business travel also presents awkward situations for women. The fear of being seen alone with a woman and having the relationship misconstrued by others often prevents male engineers from wanting to travel with female colleagues. Female engineers told of long business trips that offer little camaraderie due to the discomfort men experience in dining one-on-one with a woman, even when the meal is business-related. Also, the wives of male engineers may perceive female engineers as a threat, thus creating further awkwardness for both male and female engineers, as illustrated by the following quote from a female engineer:

*“I was there for a week and a half in a very small town. It was an all-male building that I was working in, they had a woman receptionist. Every time we went out for dinner, there were five or six of the guys and me. And after a while I found it uncomfortable. I realized what they were doing, they were protecting their reputation because it was a small town, and protecting themselves from their wives.”*

Likewise, female engineers who have travelled abroad have found that many of their foreign business associates do not feel comfortable entertaining female guests. As an example, a female engineer recounted how she was offered the services of a male prostitute as a token of an Asian company's hospitality.

Handling relationships with contractors and customers also presents a unique challenge for female engineers. For example, Japanese suppliers gave pin-up calendars as Christmas gifts to all of the male engineers in a department that also included a female engineer. The woman received stationery as a gift. In dealing with these situations, management support is of the utmost importance. In some cases, women felt their companies had been responsive and supportive. However, the human resources professionals interviewed acknowledged that conflict exists between supporting one's employees and accommodating customers who are not used to treating women as professional equals.

## *The Role of Management*

“Certainly there are a lot of [particularly the] older men who have not had a lot of experience working with women who just don't know how to relate, so they think they are being funny or cool. You are different because you are a woman and that's what is on their minds and it comes out in all sorts of dumb ways.”

*human resources  
professional*

Sexual harassment is most damaging to female engineers when it is ignored or perpetuated by top management. Women provided many examples of sexual harassment by top managers to give credence to the existence of a hostile environment for women; this was especially true in industries such as aerospace and defense. In one company, women described a training class built around the “new corporate culture,” conducted by a top management trainer, as “two days of non-stop sexist jokes.” By allowing the trainer (against whom previous complaints had been filed) to continue to teach this class, management sent a strong message that sexual harassment was appropriate behavior. Female engineers in several companies also reported that senior managers made such comments as, “Let's have the women get up on the table and dance for us,” “Your contribution is just your looks,” and “I like to see women with red fingernails and high heels in my meetings.” (The last comment was cited as a reason to promote women.)

Such comments from senior management send an overall message that women are not taken seriously as engineers or managers. In addition, female engineers felt that harassment from senior managers had a “trickle-down effect” that influenced the way in which their male peers and subordinates viewed them and showed a lack of respect for women in general. For instance, one woman recalled that a slide of a *Playboy* magazine centerfold was contrasted with a slide of an overweight woman to illustrate the difference between high- and low-quality presentation materials for customers. In another example, a belly dancer was hired by the company for a luncheon retirement party. The prevalence of sexist jokes in many of the companies participating in the research also demonstrated the acceptance of sexual harassment in this environment.

“Given that they are in more of a traditional work force, it can be a barrier because you might as well bet they are going to face it. They are going to be harassed somewhere along the line. So, if they’re not capable of coping, managing through the maze of sexual harassment... it’s going to be a barrier.”

*human resources  
professional*

Many female engineers thought that sexual harassment was a form of “testing” by their male subordinates, colleagues and managers. When female engineers expressed disapproval of verbal comments and harassment, they were criticized by their male coworkers as being overly sensitive; however, many female participants reported that such behavior ceased once the women demonstrated that they were not in the least bit affected by the comments. As one woman noted, “I felt that the head of my department was testing to see if I was going to make myself stand apart and say I am a woman, I am not going to put up with that.” Another female engineer related an incident in which a male manager singled her out in a meeting of all male engineers to test her reaction to his use of sexually explicit language. Some women felt that such inappropriate behavior indicated men’s lack of familiarity with relating to women as colleagues.

Many of the longer-tenured female engineers and supervisors interviewed stated that they had learned to handle sexual harassment as they grew more confident in their positions. Entry-level female engineers are more vulnerable to sexual harassment since they might not yet possess the confidence they need to confront harassment. In some cases, harassment has forced women to leave their companies.

## *Success Factors*

During the focus groups and interviews, male and female engineers and their supervisors were asked what factors are important for career advancement as an engineer; what factors can be attributed to female engineers who have succeeded in their organizations; and which areas or functions in engineering pose more challenge for women than men.

In discussing these issues, participants identified several success factors, including management skills, visibility, mentors, additional academic training, and structured development programs.

Clearly, these factors enhance the careers of both male and female engineers, but in some cases, they are much more crucial to women's success. For example, men appear to have less difficulty being identified by their supervisors for high-visibility projects, while women seem to encounter more

## *Management Skills*

“Some of the worst managers are those who are wonderful in the technical area but could not manage people or projects.”

*female engineer*

obstacles in gaining a variety of work experiences. Formalized, structured development programs during the first three years of a job are reported to be very helpful in enabling women to gain the valuable experience they need to compete with men for advancement opportunities.

At the entry level, female engineers are generally praised for their interpersonal skills, while their technical abilities are doubted. After they have passed the scrutiny of the first few years and are ready to assume supervisory responsibilities, perceptions of their competence are often reversed. At this time, their technical abilities have been proven. However, their interpersonal skills and their ability to get along with other members of a team, and their ability to supervise men or blue collar employees may now be called into question.

Engineers are trained to be good problem-solvers, while managers need to be able to define the problems as well as have a balance of technical and managerial skills. Therefore, both men and women would benefit from additional training in communication skills and project management as they begin to assume supervisory responsibilities. Such training, however, cannot substitute for on-the-job coaching and guidance by more experienced managers under a variety of work settings. Since management training is often assigned at the discretion of a supervisor, a female engineer's training needs must be clearly understood by her supervisor. Unfortunately, some supervisors feel that the most valuable “training” women can receive is teaching them how to stroke the egos of their male coworkers in order to manage successfully.

At the second or third level of management or beyond, interpersonal skills take on greater importance. This is when awareness of the corporate culture and politics takes on paramount importance, and informal learning from coaches/mentors could make the critical difference to career success or failure. As a female engineer explained:

*“After you’ve gotten past the second or third level of management, ...even for men, that’s the level where things may be based more on the comfort factor and on whether you went to the same school, whether you have a mason’s ring on, than it is based on your technical expertise. They feel if you’ve reached that level already you’ve got to be technically qualified. So that’s the point at which your management skills and your style have to meld better with the*

*people you're working with — it becomes more important than your technical skills — that's the point at which I think women experience greater problems."*

The importance of communications skills — in oral and written presentations as well as on the interpersonal level — was emphasized by many participants as a prerequisite for promotion to managerial rank. To begin with, these skills can be very helpful in gaining visibility with one's supervisors and acceptance by one's peers and in shaping the perception of one's performance. However, if male engineers feel uncomfortable or threatened by female colleagues, it becomes difficult for men and women to form the relationships that foster informal information sharing.

## *Visibility*

*"If he [your supervisor] is a person who wants to take all of the credit and all of the visibility upward, then you get no visibility. But if your boss has some confidence in you and allows you to make presentations to his staff ... when people see that you know what you're doing and you make good presentations, and see what type of work you're doing, that's the only way you can get your name out and get some visibility."*  
*female engineer*

Gaining visibility offers both male and female engineers an opportunity to establish and promote their own technical competence. Visibility allows senior management to become aware of an individual and her performance. For a female engineer in an overwhelmingly male environment, visibility means being noticed beyond her physical appearance and gender. Yet female engineers in the focus groups were often unsure about how to acquire visibility even as they stressed its importance. One of the most common ways to achieve visibility is to be assigned to an important high-profile project. However, these assignments are made at the discretion of one's supervisor, and it is at such junctures that perceptions, personal comfort and willingness to take risks come into play in determining whether a female engineer is sufficiently qualified to do the job.

An important step to career advancement is being identified for the fast track and being given the variety of experiences critical for comprehensive development. A supervisor's decision to groom a woman for the fast track may be colored by the general fear associated with promoting female engineers. Even though the supervisor may be personally confident and comfortable with the female appointee, he may feel that she has more of a chance of failing due to the barriers all women face. He may therefore choose not to risk promoting her because he does not want to be perceived as making a poor choice.

## *Mentors and Coaches*

“Some of the most successful women in our organization have stated that you have to be very comfortable developing personal relationships with men ... you have to be one of the gang, comfortable with developing that relationship in order to be able to find a mentor.”<sup>99</sup>  
*human resources professional*

In identifying “high potentials” for the fast track, some human resources representatives reported that their companies have had to drop grade levels to find enough women and minorities. “The consequence,” one human resources representative said, “was that the executives didn’t know them as well ... didn’t get all excited about this one or that one.”

Participants voiced a range of views on coaching and mentoring, including opinions about the gender of the mentor and whether there should be formal mentoring programs. Nevertheless, nearly everyone agreed that coaching and advice from someone other than one’s supervisor often make a critical difference in one’s career advancement. This type of knowledge sharing often helps junior employees understand informal cultural rules and corporate politics, and provides a broader view of technical subjects. One female engineer expressed her view of the importance of mentoring:

*“When you get right down to it, a mentor is one of the most helpful things because in part of my career, I’ve had a mentor and in part of the time, I have not. And believe me, it is much easier with a mentor. It’s not that they can open doors but they do make you aware of things that are going on.”*

While the success of any coaching relationship depends to some extent on a natural affinity between the two people involved, many of the human resources managers stressed the importance of mentoring programs where people are formally matched. This is especially true for engineers, since men far outnumber women in the corporate engineering workplace.

Because men serve as mentors in many cases, formal mentoring programs should be set up for both sexes so that men would not feel that women were benefitting from special programs. At the same time, as one female supervisor pointed out, corporate management could communicate to supervisors the importance of mentoring and developing lower-level engineers:

*“A corporation should give a message to managers that part of their job expectation is that they mentor and that part of their job time will be for that.”*



“If they choose to have a male mentor, that’s fine. But I think there are times when it’s nice to talk to a female that’s been through this particular job before.”  
*male supervisor*

Interestingly, even though there are more high-level male engineers than female engineers, men said that women are the best mentors for other women. Male participants feel that senior women can provide emotional support and advice when female proteges encounter difficult situations.

However, other participants argued that male mentors can best facilitate the acceptance of women as successful engineers. Male mentors may prove more effective simply because there are so few senior-level female engineers. In addition, the few senior women who are available may get “burned out,” or may be too busy fighting their own battles to serve as effective mentors. Finally, some senior women said that mentoring junior women labels them as “single-issue” women and threatens their own advancement potential.

In addition to acknowledging the importance of mentors, participants agreed that career advancement often required the sponsorship of a supervisor or someone higher up who appoints them to high-visibility projects or provides other opportunities for critical experience and exposure. Sponsors go beyond mentors in promoting an employee’s advancement. In some organizations, a beneficiary of sponsorship doesn’t even know her sponsor. Women are less likely to have sponsors than are men, which indicates that formal career development for women is critical. A human resources manager, observing patterns of development and advancement, offers the following insight:

*“No matter how good you are, unless you have somebody who is high placed and a man and willing to champion your cause, you will not succeed.”*

### *Additional Academic Training*

Participants voiced mixed responses regarding the importance of further academic training for advancing one’s career as an engineer. The value of a graduate degree is dependent upon a number of factors, such as the type of working environment, the nature of the job and the individual’s career goals.

In a corporate research environment or laboratory, an advanced technical degree appears to be essential to career advancement. All of the participants agreed that it is necessary to have at least a master’s degree and in most cases a Ph. D. to advance in a laboratory or research environment. Since the number of women pursuing advanced degrees in technical areas is even smaller than at the undergraduate level, the pool of women qualified for research positions is severely limited at the recruiting stage.

“You get a graduate degree and that’s a credential that not a lot of people have. So it becomes a form that can be used to make a person visible and help them stand out and differentiate them from the crowd.”

*male supervisor*

“I think I was chosen over two guys for the quality engineering supervisor position because I was working towards my master’s at the time.”

*female engineer*

## *Structured Development Programs*

In a manufacturing or production environment, outside or further academic training does not appear to be an essential factor for career advancement. Many of the mid-level engineers, both women and men, agreed that while a bachelor’s degree in engineering is crucial, a graduate degree will not necessarily help in advancing one’s career. Obtaining a wide variety of on-the-job experiences is more important. They felt that advancement is contingent upon demonstrating competency and ability on the job.

Many human resources professionals noted that engineers often pursue MBAs to enable them to move further up the management ladder. Additionally, many of the supervisors emphasized the importance of further academic training in order to demonstrate commitment and compete more effectively. In fact, an overwhelming majority of the managers interviewed had graduate degrees.

Some of the mid-level female engineers felt it was advisable for women to pursue advanced degrees since the degrees would provide women with stronger qualifications than the males with whom they were competing. Thus, a graduate degree may not be essential for advancement, but there was general agreement among the managers that further education could set someone — especially a woman — apart and give her a needed extra edge.

In addition to graduate degrees, many of the engineers spoke about the value of maintaining their technical skills and keeping up on the latest trends in their fields by reading journals and attending enrichment classes. At one participating company, classes with specialists in the field, including academic experts, were offered to engineers.

College co-op programs and summer internships are excellent ways for young female engineers to gain experience and establish technical competence. Companies recruiting women sometimes send female engineers to campuses to recruit college women for summer or co-op internships. Often, companies will hire engineers after their graduation if they have had successful summer or co-op experiences with them.

“I would recommend co-opping because you gain that confidence, you lose your insecurities as you are still a student, and then when you graduate into that position you are much more confident and you get accepted much faster.”

*female engineer*

“By requiring this rotation, you’re not going to be trapped in your first job by something that is limited because of people’s perceptions. There’s a built-in variety and choices, so you can see if something is a bad position for you for any reason. I think these things are good for anybody’s career, but they’re especially good for women.”

*female engineer*

## *Management Commitment*

More and more younger women are realizing the value of internships and co-op experiences, which provide exposure to many different areas and help students make decisions about their career goals. During the course of an internship, the intern has a chance to demonstrate her competence and build confidence.

Internships and co-ops also help establish greater acceptance of women in a company and lead to better working relationships than those often experienced by entry-level female engineers. In addition, a mentor-like relationship is often established between the intern and the supervisor, which facilitates the intern’s acceptance and advancement once she joins the company full-time. A few women interviewed stated that they had accepted job offers at lower salaries at companies where they had interned or co-oped rather than accepting higher-paying offers from companies where they had not had the opportunity to establish relationships or demonstrate their competence.

Rotational programs are also beneficial to women because they provide a variety of experiences and opportunities necessary for career advancement. Female engineers often lack certain types of work experience necessary for advancement, such as plant or manufacturing experience, because male supervisors feel that women do not want to be or should not be in certain work situations. Structured rotation programs that provide both women and men with a variety of work experiences, including research and production experience, help to remedy this situation. Female engineers spoke highly of rotation programs. They noted that such programs help women establish competence and increase their confidence as new line engineers. Moreover, rotation programs provide newly hired female engineers contact with experienced professionals who can serve as role models, as well as a network of associates. Some of the entry-level rotational programs even include assignment to a mentor. This may prove to be the most important aspect of rotation programs; as noted previously, women often find it more difficult than men to establish a network of associates and contacts within the company.

Participants had mixed views about management’s commitment to the advancement of women. Some participants felt that senior managers were very supportive of women; yet many of them noted that this support did not

filter down to lower levels of management. Others felt that, increasingly, senior managers were aware of the issues, but that there was no action taken to support the advancement of women. Additionally, some of the human resources professionals expressed the concern that even supportive senior managers were too far removed from the issues to make anything happen, as demonstrated by the following quote from a human resources professional:

*"I think one of the issues with senior management is it's very easy to sit up on the walnut floor and say, yes we ought to have more women, and one of the things we're trying to do at [our company] is get the senior managers a little bit closer to the front."*

The majority of engineers however, felt that senior managers gave these issues lip service and nothing more, and some of the participants commented that senior managers were not even interested in human resources issues — only in the financial performance of the company. (They did not feel that human resources had an impact on financial performance.) As a female engineer and a male supervisor (respectively) noted:

*"Management, they're not all in favor of it. You know you can find somebody who will listen and who's sensitive, but it's not across the board, and it's not necessarily the people who are most important, at least not most important to your career."*

*"I think there is a strong commitment at the top. At my level, I would say, the middle management level, I would say that it's more in words, and yes we agree with it but when we're in a little group, we'll talk negative about it."*

*"I've heard a lot of lip service, but I have not seen it implemented."  
male engineer*

While the views differed on whether or not top management support for women existed, participants agreed that commitment from the top is vital in terms of advancing women and developing policies to help retain them. Many of the women and the human resources professionals interviewed noted that an emphasis on encouraging and promoting women, similar to the "quality" movement taking hold in many companies, entails a cultural change process. As one male supervisor noted,

*"The fact that you've got to have the infrastructure, the policies and procedures, a second portion of that is you have to have the value system. So you are really talking about a cultural change..."*

## *Becoming "Female- Friendly"*

*"To recruit women engineers you have to have a reputation as progressive, that's the challenge. I'm not sure what our reputation is, but I suspect it's not good..."*  
*female supervisor*

*"I think they have a long way to go in having a program that really retains women."*  
*female engineer*

The few individuals who felt that senior management was committed to human resources issues saw tangible evidence to support their beliefs. For instance, one male senior manager noted that at his company, supervisors are evaluated on the initiatives they undertake to promote and develop both women and minorities. In another case, a female supervisor pointed to her company's mentoring programs for high school students and its annual management review of high-potential women and minorities. She felt senior managers were committed due to the resources and time they devoted to these issues.

Several of the female engineers and female supervisors noted that their companies' recruitment and retention of women would benefit if they became "female-friendly." As one female supervisor noted:

*"It's intimidating when you realize you're in a company [in which] there are no women in upper management. [You think] I've got to blaze this trail, fight...years of discrimination or 'no women have ever been in upper management young lady...' That's intimidating and if you're comparing that company to one where they've got ten women in upper management, you say, 'Hey, they're open minded; they've realized that women can do the job and they're willing to raise women to those types of positions.' That company would be more attractive."*

Most of the participants acknowledged that their companies needed to do a great deal more in order to be "female-friendly."

In companies that have attempted to foster a more supportive environment, women have recognized this effort, as illustrated by the following quote from a female supervisor:

*"I think [the company] is a great place to be a woman. It's a great time to be a woman at [the company] because I think there is a very strong affirmative action atmosphere here and it helps to counteract some of what might be prejudices."*

Some men also acknowledged the importance of a company's "female-friendly" reputation to attract more women to the company. A male supervisor stressed the importance of developing an environment within the company in which women feel respected and valued. Most of the men felt that their companies could develop many more "family-friendly" policies that would benefit men as well as women; as one male engineer noted:

*"You sort of solve the problem to a certain extent if what you concentrate on is things that not only make life in the corporation more comfortable for women, but also for men. Then you've done no wrong."*

"If you get a reputation for being a company that hires women and has a lot of them doing good things and a lot of role models and you publicize that somehow, I bet you'd draw a lot of women... they'd come here."

*male engineer*

While human resource professionals described various work and family programs and policies that their companies had developed, the majority of engineers and supervisors felt that their companies could do much more in the way of dealing with these issues and developing women. They suggested the institution of mentoring programs, career development plans, family-supportive policies and increased sensitivity to women's issues.

At some companies where family-supportive policies did exist, some employees felt that they were not able to use them, as one female supervisor explained:

*"You'll hear the media say that [the company] is ranked as one of the great companies for women to work for and that's because corporate has all these policies on doing job-sharing and our flextime and part-time work for women. You know, they have all these policies but it's not feasible for a supervisor to actually do them."*

Many women also expressed doubt about whether these programs had any substance, and felt they were token gestures. Others acknowledged that change was occurring at a very slow pace. One female supervisor described the change as being very controlled, while another supervisor felt that companies had just begun to remove obstacles to women's advancement.

Some of the men and women noted that these issues would be resolved if general "people management" skills were enhanced and seen as critical to the success of the organization.

A few of the participants in supervisory and human resources positions noted that their companies were undertaking more systematic efforts to encourage and promote qualified women. These efforts included identifying high-potential women and ensuring that their development was monitored and encouraged, as well as linking managers' compensation to their demonstrated support of women's career advancement.

## *Female Engineers as Role Models*

“Number one is getting the word out to youngsters when they are in grade school, junior high school and high school that there's a great career out there for women.”

*female engineer*

“Whatever people can do to get more women interested in these kinds of careers is critical.”

*male engineer*

All research participants, regardless of level or gender, agreed that it is vital to increase the number of women in the pipeline for engineering positions at various levels. Previous sections have addressed the role of more senior female engineers as beacons for those coming up the ranks. In addition, there was a strong feeling that female engineers can serve as role models for girls in elementary, junior high and high school. Due to stereotypes about engineering and the lack of knowledge about the field, girls do not often choose to study engineering.

The participants discussed how important it was to expose girls at an early age to the field of engineering in order to dispel the stereotypes and myths they might have about engineering in general and the type of women who go into the field. The following quote from a male engineer illustrates this need:

*“When you think of engineers, the stereotype is a male...When I was in high school and I was good in math, I was pushed to go into engineering; whereas if it was a girl who was good in math, I don't know if she'd be pushed to go into engineering. It has to start even before the high school age.”*

The importance of early exposure to the field became clear in speaking to female engineers, many of whom had a father or a male relative who was an engineer and a role model. In addition, the participants felt that it was necessary to educate girls about engineering at a very young age, since those students who are considering the possibility of studying engineering in college must take the necessary high school math and science courses to prepare them for university-level study. One female supervisor voiced this opinion:

*“Recruiting might start earlier than college, in elementary and high school. It would be good for women to go into math and science and study computers...It would help break the stereotype of women in engineering.”*

Many human resources professionals and other research participants noted that their companies were already involved in awareness or outreach programs designed to educate both girls and boys at a younger age about technical and engineering careers. One human resources professional described the program's benefits:

*“Just by seeing them in that environment we lifted one barrier to their perception, let alone the number of barriers we’ve been able to erase by bringing them in and following, shadowing, mentoring, we tutor twice a week...We say what is an engineer, what is a computer scientist...Just the eye-opening that occurred: the kids saw that these women engineers could wear high heels and be feminine.”*

One female participant noted the positive impact of actually going to a classroom to discuss the opportunities in engineering and science; in learning about her job, the girls showed enthusiasm and interest in the field. Many companies have started such outreach programs to increase recruitment of women into the field, and most of the participants acknowledged that the issue is critical. They felt that companies must do even more in working within the community to reach out to young women and educate girls at an early age about the field of engineering and the many opportunities and challenges it provides.

In addition, companies need to make conscious efforts to involve female engineers in these efforts and allow them to take time from their work to pursue these activities. Involving women and providing them with opportunities to speak about their achievements will boost their morale while exposing young people to women who have been successful in the field.



# *Recommendations and Model Programs*

Catalyst's research was designed not only to examine the obstacles facing women in the field of engineering, but to determine how those barriers could be eliminated and more opportunities for female engineers could be created. Drawing on research findings, Catalyst's 30-year perspective of working with women and business, and the insight provided by this study's advisory board, the following section offers recommendations to business leaders and policy planners for enhancing the recruitment, advancement and retention of female engineers. Recommendations are arranged to correspond with the findings presented in the last section. Model corporate programs that supplement selected recommendations are described in detail.

## *Encourage the Formation Of Women's Networks*

The formation of corporate women's groups provides opportunities for women to share information and gain support, particularly in the engineering environment where women feel a strong sense of isolation. Some of the female participants acknowledged that they did not receive support from management in formulating a corporate women's group. As noted in the findings, many women were reluctant to become involved with such groups for fear that it would be detrimental to their careers.

Because the corporate engineering culture is so male dominated, women often do not have access to critical business information gained through the old boy network. Consequently, women need a forum in which they can exchange information, discuss the difficulties they confront in their daily work

environment, and the ways in which they can overcome them. Just as importantly, these networks can serve to support women's technical "instincts" and affirm their progress and achievements, which are so often overlooked in male-oriented, hierarchical organizations. If women from all levels participate, these groups can serve as excellent tools for career development, informal mentoring and role-modeling opportunities. In addition, these groups can assist senior management in defining pertinent concerns to women and helping to formulate new policy.

## *Texas Instruments*

*Texas Instruments' Corporate Services Women's Initiative is a management-supported group of approximately 50 female engineers, managers and technical employees. Founded as a grassroots effort by two women in 1990, the stated charter of the group is to champion the full participation of Corporate Services women at all levels and aspects of the business by promoting their professional and personal goals.*

*"We started the Women's Initiative to give women the chance to network and learn about job opportunities. There were only one or two women in each department, so we were often left out of the communication loop," reports founding member Colleen Dominguez, Travel Strategy Manager. Dominguez says management bought into the idea from the beginning because she and co-founder Barbara Cofield positioned the initiative as something they could do for the company, rather than something the company could do for them. Underscoring its commitment to the network, management made it a subcommittee of Corporate Services' Senior Management Committee.*

*In this capacity, the Women's Initiative helps top management understand and resolve issues that will enable the company to better recruit and retain women. For example, Dominguez and Cofield figured more women might join the company if, during interviews, they met with women who have risen to the professional level. "It's important for female recruits to have role models," adds Connie Wharton, Vice President of Corporate Staffing and network member.*

*Throughout the year the group fills a company auditorium by bringing in high-profile speakers to talk about career and leadership development. Last year, Congresswoman Patricia Schroeder made an appearance.*

*Using the Corporate Services Women's Initiative as a model, five additional women's networks have formed in other company divisions. Because Texas Instruments is highly decentralized, Wharton notes that a single larger group would not be as effective in addressing the specific and differing concerns of the various businesses.*

*Dominguez feels that her own increased self confidence, and that of the members, is one of the initiative's greatest benefits.*

## *Create Greater Opportunities and Rewards For Employees On the Technical Track*

Almost all of the study participants said the way to advance through the corporation is through the management versus the technical track, and they felt that more opportunities, in terms of rewards and recognition, needed to be created on the technical track. As organizations cut managerial levels and become flatter, the technical track will become increasingly important. Efforts should therefore be made to increase the visibility of positions and opportunities for achievement on the technical track, thus tapping women's passion for engineering and their desire to be at the forefront of innovation. Clearly, technical employees should be valued and respected for their work, and companies should ensure that the compensation, responsibility and influence of technical positions are commensurate with managerial positions of similar rank.

Developing the technical track and valuing rather than devaluing technical employees will create more opportunities for both male and female engineers. However, opening up the technical career path is particularly important for women's career advancement. As noted in the findings, many of the women Catalyst interviewed perceived a general lack of options because technical positions offered little advancement potential, while managerial positions were seen as being very difficult for women to obtain.

Companies should also make employees, particularly entry-level engineers, aware of the career options offered by the different tracks. Holding career seminars and career days increase employees' exposure to and knowledge of the different options. In addition, rotational programs should include both technical and managerial assignments, so new engineers can see whether they are interested in pursuing a career in a research environment, for example, or in overseeing production.

## *Support Employees In Balancing Work and Family Responsibilities*

Balancing work and family was of paramount concern to all of the participants (men and women) and was discussed at great length at both the focus groups and interviews. Greater scheduling flexibility is crucial to retaining women with family responsibilities. Clearly, flexibility will become increasingly important since the largest numbers of women entering the engineering field are now or soon will be in their late twenties or thirties, a time when most professional women have children. Policies such as extended parental leaves after the birth or adoption of a child, flextime, part-time and job-sharing options are needed to help women and men adjust to their new roles as parents without having to leave their jobs. Catalyst has found in previous research that piloting these types of policies is an effective way of testing their feasibility. Many of the participants also cited the need for greater assistance with child-care responsibilities, such as increased resource and referral information and provision of on-site or near-site child-care facilities. (Statistics show that only a small percentage of major U.S. employers provide on-site or near-site child-care centers. According to a 1990 study by Hewitt Associates, only nine percent of employers offering child-care assistance provide an employer-sponsored center, while 41 percent offer resource and referral services.)

Management training in the area of balancing work and family is also important. In many cases, where corporations had developed policies that offered arrangements such as part-time work or job sharing, participants felt it was impossible to make use of such options because supervisors were not amenable to having employees utilize them. Moreover, they felt their career

commitment would be doubted if they expressed a desire to work a nontraditional schedule or take longer than a month or two to be with a new baby. Thus, if a company is going to offer work and family supports, it is important to educate supervisors about the policies and how the company benefits by offering and encouraging the use of such programs.

Finally, a company's human resources or personnel department should take responsibility for communicating the availability of work and family supports to all employees, especially those at plant locations who may be unintentionally left out of the communications loop. When E.I. du Pont de Nemours and Company created an array of work and family benefits, the company ensured that employees at plant locations learned of the benefits by sending a video to plant managers.

## *General Electric*

*Two units of General Electric, its aircraft engineering and aerospace divisions, recently introduced a range of family benefits in response to changing work force demographics and to reduce attrition of female employees.*

*After surveying 550 employees in the aerospace division, the company was surprised to find that many would consider changing jobs for better family benefits. When the unit responded by offering family leave and a flexible work arrangements policy, 1,500 of the division's 40,000 employees used the new options in the first year. All 203 employees who tapped into the part-time work option were still at the company a year later.*

*In the aircraft engineering division, Human Resources Manager Kathy Duggan reports that an attrition rate of female employees that was higher than that of male employees prompted the unit to introduce a child-care referral system; a part-time work policy, which includes job sharing; and an unpaid parental leave of up to one year. To foster support among part-time female employees with children, the human resources department organized a lunchtime networking hour.*

## *Ensure That Women Are Well Represented On Visible Team Projects*

Increasingly, corporations are recognizing the value of multi-discipline and multi-level teams and are adopting a more team-oriented approach in conducting their business operations. Serving on task forces and interdepartmental team projects provides valuable opportunities for increased professional contact and visibility, as well as developmental experiences outside of a person's usual job functions. These opportunities are important in providing exposure and increasing one's network. Intentional efforts should be made to target women for these assignments, and their career development plans should specifically include involvement on task forces and team projects. These assignments will allow women to further demonstrate their technical capabilities, in addition to enhancing their visibility and enlarging their networks.

## *Develop Formal Mentoring Programs*

Formal mentoring programs need to be established in order to provide women with greater opportunities for networking and receiving guidance. As noted earlier in the findings, many research participants felt that the best mentor relationships were established by the natural affinity that develops between two people. However, most participants agreed that women do not have the same opportunities as men do to establish informal mentoring relationships because of the discomfort experienced between genders, the lack of female role models and the limited network that women may have. Growth and success of all employees are enhanced in an environment that pairs new employees with experienced coworkers who can serve as mentors and coaches. Mentoring offers an increased sense of belonging and company loyalty. Teamwork and shared values are enhanced by mentor/protegee pairs. Indeed, studies have shown that mentoring programs reduce turnover as well as reduce training and development costs. By encouraging learning and behavioral changes, mentoring also leads to improvements in performance and productivity.

## *Colgate- Palmolive Company*

The role of the mentor can be characterized as guide, role model, coach, counselor, advisor, communicator, champion or confidant. As a guide, the mentor helps an employee overcome the discomfort of being new to the company or department by acting as an available resource person. Role models and champions give support and help the employee build confidence and gain recognition for her achievements. Advisors and confidants act as sounding boards and share unwritten company rules, such as culturally appropriate dress or speech.

*Colgate-Palmolive Company's New Jersey-based Corporate Technology Group instituted an orientation/buddy/mentoring program for all new hires in 1990. Within two weeks from the date of hire, the new employee participates in a two-day, in-depth orientation, which includes a review of the company's services and divisions, strategies and goals, mission, total quality excellence program, cultural diversity policies, human resources policies, performance and appraisal process, career opportunities and benefits package. "New employees then meet one-on-one with the head of their division to learn how their responsibilities are linked to their division's objectives," reports Ron Martin, Director of Corporate Employee Relations. For the employee's first 90 days on the job, an assigned "buddy" from her department is available for support. After the employee has been at the company for 90 days, she is matched with a mentor at least two grade levels above her for one year. The formal mentoring program is particularly helpful in developing the "people skills" of the Technology Group and ensuring that women get the same opportunities for mentoring as do their male colleagues.*

## *Build Partnerships With Colleges and High Schools*

As discussed in the findings, early exposure to engineering is particularly important since many of the women were attracted to the field by role models, such as fathers who were also engineers, and were exposed to the profession at an early age. Many of the companies in the study were reaching out to high

schools and colleges to attract more students, particularly young women and minorities, to the field of engineering by encouraging them to study mathematics and science and offering them summer internships. However, participants felt that the dwindling supply of students entering the field was such a concern that their companies should devote more resources to attract and increase the supply of women in the field.

Female engineers currently working in the field can serve as role models to students by attending high school and college career days, speaking at schools and serving as mentors to summer interns. It is in companies' best interests to encourage their female engineers to participate in outreach programs and allow them to devote company time to do so. Further, women who participate in these programs often experience a sense of achievement, empowerment, and pride in their careers. It is important, however, that companies are sensitive to the work needs and project deadlines of the women chosen to perform outreach activities. Companies should ensure that certain women are not overburdened with requests, and that men do as much outreach and/or recruiting as women. If not, the message women hear is that their hands-on contribution in the workplace is less important than men's.

Companies may want to reach children at the elementary level and increase their knowledge of the field. Many of the engineers Catalyst interviewed felt that young children rarely have an understanding of the engineering profession or even a mental image of how an engineer might look or what an engineer might do, as they might for a doctor or a teacher, for example. When companies send engineers to elementary schools to explain in real terms the kinds of jobs engineers do, the children are fascinated. Clarifying the jobs of engineers not only helps to boost the image of the profession, but gets young people started on (or at least thinking about) the course of study they need to be accepted to engineering colleges.

## *Exxon Research & Engineering Company*

*Exxon Research & Engineering Company introduced an internship and mentoring program for female and minority high school students in 1988. "The goal of the program is to increase the pool of female and minority recruits," reported a company representative. By providing students with professional-level mentors who serve as role models and*



*career counselors, as well as "real" engineering work experience, Exxon aims to build positive, long-term relationships with students and to foster their interest in becoming permanent company employees.*

*Each summer, the company employs approximately 30 juniors and seniors from five New Jersey high schools as full-time, paid interns. Each intern is provided with a mentor, who volunteers for the position and is selected on the basis of company experience and strong interpersonal skills. Mentors attend a half-day training workshop to clarify their responsibilities.*

*Although it is a formal program with mentoring guidelines, the company lets mentors define their own roles and time commitments. Some mentors invite their proteges to business meetings, to their homes for dinner or to ball games on the weekend. Many mentors stay in touch with their proteges after the summer session ends, helping them with homework, choosing colleges and completing applications. Mentors and proteges evaluate the program at the end of each session, and positive feedback has led to its continuation and expansion.*

## *Offer Rotation Opportunities for Entry-Level, High-Potential Employees*

Several companies participating in the research offered entry-level job rotation programs. While they were not exclusively for women, researchers found that women benefitted greatly from them. Job rotation offers exposure and visibility to different areas within the company, including production, research and technical areas, thereby helping new employees define their career interests and broaden their skills. In addition, rotation programs provide employees with a network of peers or associates who are also involved in the program. One company representative reported that the participant's network typically extends beyond one's peers to include alumni of the program. Some of the rotational programs Catalyst studied had built-in mentoring structures, which also proved particularly beneficial to the female participants.

Positions in job rotation programs are more difficult for women to obtain than for men. Without a formal rotation program, women may not have the same opportunities as men do to be recognized and to develop a network or support system. In the words of one female engineer involved in her company's rotational program, "It was a gift."

It should be noted that in order to be effective, rotation programs must involve meaningful assignments that give participants an opportunity to make a noticeable contribution. Generally, each new assignment or position should last several months to ensure an adequate learning experience. Additionally, rotation programs should address such issues as headcount, salaries and benefits. Most of the companies that had a rotation program delegated a corporate division to serve as the cost center for the engineers in the program; otherwise, the individual divisions would have to cover the costs and therefore would not be as inclined or able to use the program.

## *Consolidated Edison*

*The purpose of Consolidated Edison's Management Intern Program is "to develop the future managers of the company," reports Vincent Frankel, Manager, College Programs. Begun in 1981, the program currently recruits approximately 30 college graduates annually on the basis of technical competence, leadership potential, communication skills and part-time work experience. Of the 1991 Management Intern class, 42 percent of participants were women.*

*Interns spend one year in four three-month assignments designed to expose them to a variety of company functions. Most assignments involve hands-on work considered "nontraditional" for women. Interns may serve as Maintenance or Watch Supervisors at a power plant, for example, or supervise union employees in the field. Frankel reports that the competence and professionalism of women in these jobs has made a definite impact on their acceptance by a primarily male work force. Most assignments are operations-oriented and are designed to give interns an opportunity to make a noticeable contribution to a specific department. Visibility is an added program benefit: Interns gain exposure to officers and upper management through required presentations and informal forums.*

*At the outset of the program, each intern is assigned a mid-level manager who serves as a mentor, showing her the ropes, helping her make connections and later guiding her to appropriate job opportunities. Besides cultivating future company leaders, the program pays off in retention: Of the 89 female engineers hired since 1981 as Management Interns, 67 are still at Con Ed; women in the program have a higher rate of retention than men.*

## *Formulate, Communicate and Enforce a Policy Prohibiting Sexual Harassment*

Research showed that female engineers—across the board—were subject to and undermined by sexual harassment. Sexual harassment, as defined by the Equal Employment Opportunity Commission, refers to the “unwelcome sexual advances, request for sexual favors and other verbal or physical conduct of a sexual nature.” Specifically, sexual harassment occurs when:

- submission to such conduct is made either explicitly or implicitly a term of an individual’s employment or promotion;
- submission to or rejection of such conduct by an individual is used as a basis for employment decisions affecting the individual; or
- such conduct has the purpose or effect of unreasonably interfering with an individual’s work performance by creating an intimidating, hostile or offensive working environment.

As more women enter the field of engineering and hold jobs in traditionally male-dominated environments, sexual harassment will continue to be a problem for employees (especially women) and for employers who take anything less than an aggressive approach to eradicating sexual harassment from the workplace. Sexual harassment can and often does result in serious emotional damage to the victim and, increasingly, in huge financial costs to the company. Equally significant are the corrosive effects that sexual harassment has on the workplace itself. Employees who are harassed, by offensive or hurtful jokes or by unwelcome physical contact, are likely to underperform or to leave. When sexual harassers are tolerated, the victim’s

perception of the company is soured, and ill will and poor relations may develop among all employees. Morale, productivity and the quality of work life are compromised by sexual harassment.

While many of the companies participating in the research had a policy prohibiting sexual harassment, few took the necessary steps to communicate or enforce their policy. Pin-ups and sexually explicit calendars were found to be common in the engineering workplace, especially at plant locations. Companies should know that such items, which are not illegal in and of themselves, are the very items that complainants point to when showing how the environment is "intimidating, hostile or offensive."

The key to creating a harassment-free environment starts with the development, communication and serious enforcement of a policy prohibiting sexual harassment. The policy should come directly from the company's CEO or president to demonstrate that top management does not condone sexual harassment. It should articulate the employer's strong disapproval of harassment and give examples of illegal behavior. Moreover, it should include a confidential grievance procedure, as well as the sanctions that will be imposed on offenders. Widespread communication of the policy is critical to its effectiveness. Employers should distribute it to all employees, especially to supervisors, post it on company bulletin boards and incorporate it into the employee handbook. Management should take responsibility for reiterating the policy at least once a year in the internal company newsletter. Finally, the company should provide specific training for managers on handling and preventing sexual harassment.

### *E.I. du Pont de Nemours and Company*

*E.I. du Pont de Nemours and Company's comprehensive strategy to combat sexual harassment stemmed from the company's award-winning rape prevention program developed in the mid 1980's. Titled "A Matter of Respect," the program aims to create a responsible and respectful environment free of sexual harassment and discrimination. A four-hour workshop, which to date has been attended by nearly half of the company's 40,000 domestic employees, is led by a male and a female facilitator. The workshop uses a videotape of real-life examples of sexual harassment, including the more subtle forms, the offensiveness of which men are often unaware. After an employee discussion of their perceptions of sexual harassment, the facilitators define the legal parameters and implications of sexual harassment. Another video*

*shows the company's chief executive officer expressing his disapproval of sexual harassment. The final segment of the workshop outlines the resources available to employees (including a 24-hour confidential hotline) and the actions they can take. It ends with a discussion of how participants can examine their own behaviors and improve their working environment by sharing the knowledge they gained in the workshop.*

## *Hold Managers Accountable for Recruiting, Developing and Retaining Female Engineers*

A company can effect radical change for its female engineers by holding managers accountable for recruiting, developing and advancing them. Accountability programs work by including effectiveness in developing and advancing women as a criterion in managers' performance reviews, and by basing a portion of their bonus on their results or "good faith" efforts. Simply stated, accountability programs "add teeth" to business leaders' commitment to advancing women.

Goals are typically established by division heads or a corporate team including the CEO and human resources executives, who assess their current and future business needs, identify high-potential female employees and work with managers to develop career plans that prepare these women for senior positions. When meeting with managers, the "accountability team" should emphasize the competitive advantage the company stands to gain by attracting and retaining female engineers. Meetings with managers concerning these issues convey the company's commitment to the advancement of female engineers and underscore the vital role middle managers play in achieving company objectives. Sending this message "down the pipeline" is extremely important. Indeed, many of the study participants felt that while top management was committed to increasing the number of female engineers, their message was not acted upon at lower levels of management. Successful initiatives depend on clear communication and support from top management,

whereby mid-level managers understand their responsibility and the bottom-line benefit to their company (and therefore to themselves) and are held accountable for achieving results.

## *Square D Company*

*As an electrical equipment manufacturing company, Square D Company has a history of attracting white male engineers. But over the past several years, Square D's senior management has made a commitment to increase employee diversity.*

*Goals for preparing high-potential female employees for management positions (at salaries of \$60,000 and above) were developed and presented to senior executive staff. In 1991, it was decided that a minimum of 20 percent of managers' bonuses would be based on their effectiveness in meeting corporate goals to recruit, develop and promote women.*

*Three to four years ago, there were no women at Square D at the director level or above. In 1990, women filled 12 out of 600 top spots. Square D's goal for 1991 was to have 15 women at director levels or above, and it exceeded its goal by 60 percent. This year's goal is 40 women. And in 1993, the company plans to have 70 women in top jobs.*

## *Provide Management Skills and Diversity Training*

Many of the study participants felt that training supervisors in management and "people" skills would resolve many of the obstacles that female engineers encounter. Indeed, supervisors play a vital role in developing employees' skills, helping them define their career paths and negotiating conflict. To a large degree, one's supervisor determines his or her perception of and experience at the company. Being an effective manager and leader is not an innate ability; it must be learned through training and years of practice. It is in companies' best interest, then, to make managerial training a requirement for all supervisors.

Diversity awareness training should be included as a major component in managerial training. As the composition of the work force changes, supervisors need to develop a greater understanding of the needs and issues facing women and minorities so that they can manage, motivate and guide these employees more effectively. Diversity training, in order to be effective and taken seriously, should start with top management. Many companies conduct pilot training programs with upper management before they implement the training companywide.

Training in gender awareness, which is typically included in diversity training, has proven highly effective in surfacing and dispelling stereotypes, fostering compatibility and respect among employees and eliminating the more subtle or attitudinal obstacles that inhibit productivity. In conjunction with other more hard-hitting programs to eradicate the barriers to women's advancement, gender awareness training can significantly improve the working relationships between men and women. Gender awareness training is especially important for supervisors who oversee women in non-traditional positions, such as engineering, technical positions and other male-dominated areas.

Senior management should emphasize the importance of supervisory and diversity training to the company's overall productivity and competitiveness, and convey to managers that the development and retention of employees, particularly female and minority employees, is an important part of their job.

## *Kraft General Foods*

*Kraft General Foods embarked on its Diversity Management process in early 1990 with the objective of changing the company's culture.*

*"We're seeking to create an environment where all differences are valued, and where these differences are managed so that all employees have the resources to develop to their fullest potential," says Jean Spence, Director, Diversity Management.*

*According to Spence, the impetus of the effort was top management's growing understanding that many women were not developing to their full potential. They also knew that many more women were leaving the company than men. Two internal studies—a series of one-on-one interviews with male managers in two divisions, and a broad management attitude survey—revealed that male managers were*

*unaware of or did not understand how to resolve the problems women were experiencing. The survey also confirmed that women felt their advancement within the company was limited due to cultural or attitudinal differences between them and their male colleagues.*

*"In addition to these findings, we knew that other companies were creating programs to better recruit and retain female employees, and we were concerned that we would not be able to attract the best and brightest female talent," adds Spence.*

*General Foods began its diversity effort by forming a Diversity Management Steering Committee, chaired by the President and including 10 senior executives, to monitor all company activities relating to affirmative action and diversity management. A full-time human resources position dedicated solely to diversity management was created, along with a Workforce 2000 Council to address the issues of women's upward mobility, networking and career/family balance.*

*A huge training effort was then launched and is now being rolled out to the entire salaried employee population. To date, General Foods' Operating Committee and approximately 3,000 other employees, including senior and middle-level managers, have participated in the training. The goal of the training is to increase awareness of changing work force demographics, the diversity efforts of competing companies, and the internal cultural barriers that inhibit the productivity of women and minorities. A specific segment of the training focuses on cross-gender communication and effective coaching.*

## *Showcase the Contributions of Female Engineers*

Because there are far fewer women than men in a typical engineering workplace, and due to the stereotypes that some men still have about women's lack of ability in the areas of mathematics and science, women's achievements can go unnoticed. Companies can help enhance women's morale, dispel men's stereotypes and boost their own image as a women-



friendly employer by taking opportunities to highlight the achievements of their female engineers. The most cost-effective way to do this is by profiling female engineers in the company newsletter and publicizing outside awards or accomplishments of female engineers. The following example, a worldwide conference for female engineers, represented a significant cost to the company, but one which the company felt was a sound investment, in that it increased retention and recruitment and improved its reputation as a progressive employer. While Hewlett-Packard men did not attend the conference (with the exception of the chief financial officer and several other high-ranking men) they learned of it through videos the company disseminated and in the organization's newsletter.

## *Hewlett-Packard Company*

*Hewlett-Packard Company's Technical Women's Conference began as a grass roots effort by company women to showcase the achievements of HP's female engineers and scientists, promote their leadership development and help them to network in a highly decentralized organization. After its successful first Technical Women's Conference held in October 1988, the company sponsored a worldwide conference in May 1991, drawing 800 attendees—double the number at the first conference.*

*The 1991 conference included welcome addresses by the company's Chief Operating Officer and by senior-level female managers. In addition, female engineers and scientists presented their work in a series of technical sessions. The second part of the conference featured career-development workshops on such topics as negotiating skills, career planning, building networks and working with individuals from different cultures. Participating in the workshops and developing technical contacts at the conference sometimes leads to cross-functional opportunities and advancement for HP women. Several awards, including the Technical Achievement Award, the Leadership Award, the Distinguished Achievement Award and the Best Paper Award, were presented to individual women. The purpose of the awards is to recognize and enhance the visibility of female engineers and first-level managers.*

*Senior management demonstrated its commitment to the event by supporting it in years when other corporate conferences were cancelled, serving on the advisory planning board, allowing planning on company time and participating in conference workshops. Hewlett-Packard expects the Technical Women's Conference will result in improved recruitment and retention of experienced technical women.*

*In the words of HP President and CEO John A. Young, "Women's technical achievements are vital to the success of a global high-technology enterprise like Hewlett-Packard. The Technical Women's Conference has become an important forum for encouraging and recognizing outstanding contributions by women to HP, and it deserves the firm support of management."*

## *Encourage Lateral Mobility For Development, Challenge and Retention*

As organizations are eliminating layers of management and becoming flatter, it is increasingly important to retain the top talent within the organization by continuing to provide challenging developmental opportunities. One way to do this is by moving people horizontally, into different functional areas or to different "tracks." These types of moves may not represent promotions, but, if intelligently planned, they can offer important developmental assignments that give a person broader, more well-rounded experience. Lateral moves may also provide the necessary experience to advance later on in the organization. In addition, lateral moves offer employees the opportunity to learn new functions or areas, which will present new challenges and keep them motivated.

Strategic lateral mobility can be especially beneficial to female engineers. It may include experience on the production or manufacturing side, which some women lack. This experience is important for advancement and development of a greater understanding of the company's operations.

## *Build Women Into Succession Planning*

Although job rotation programs can facilitate the career development and advancement of employees at the entry level, Catalyst has found few programs designed to develop engineers at the middle levels. This is particularly important since the highest ranking women are generally clustered at the middle levels. Representatives from some of the companies that had rotational programs spoke about the expectations these programs raise among participants concerning their career development and advancement. Once the program ends, they are typically left on their own, and in many cases their expectations are not fulfilled because there are no formal structures for continuing their career development. In general, women have more difficulty than men in creating their own structures because they have far fewer role models and feel excluded from the male-dominated “power” networks.

Strategic, companywide succession planning and tracking of high-potential employees is needed to fill this void. The developmental needs of mid-level engineers should be identified to ensure that they obtain the appropriate assignments and training they need to advance. In addition, researchers found that high-level jobs are rarely posted; employees often learn of such jobs and secure them through networking. A more formal approach to development would therefore benefit all employees and would help the company to systematically identify and more effectively utilize employee talent.

Top management awareness of how women are progressing within the company and whether women are being targeted and prepared for senior positions needs to be enhanced, so that all levels of management feel responsible for developing women. Succession planning for senior managers—those at the highest level in a company—is common practice. However, most female engineers have not reached the levels where they are being considered for these jobs. As a result, senior management may not be aware of the female talent that exists within their company and the company’s ability to cultivate that talent.

Several of the companies that participated in the study conducted "drop-level," or sophisticated, companywide reviews of both women and minorities. Because women were not at the levels at which top management would ordinarily monitor their development or even notice their potential, the companies decided to make top management aware of the female talent that exists by extending succession planning to women at lower levels.

### *Public Service Electric & Gas Company*

*At Public Service Electric & Gas Company, a Newark, New Jersey-based utility company, a multi-level, companywide succession planning process was adopted in 1981. Succession planning at PSE&G now involves every management level employee in the company's seven business units. "Last year we started looking much more closely at women and minorities," says Judy Korske, Administrative Coordinator of the Electric Business Development unit. "Senior management is sending a strong and clear message that we need to increase the number of women and minorities at all levels of management, because they are the groups who will make up the majority of work-force entrants in the next decade."*

*Once a year, each department head completes several succession planning forms: One is an organizational chart, on which succession candidates, their readiness dates and their development needs are identified. Another form asks department heads to indicate any human resources issues they're confronting. "The lack of women and minorities is an issue that always comes up," adds Korske. Finally, department heads rate the performance of each employee on a scale of one to five—one indicating a high-potential fast tracker; five indicating unsatisfactory performance.*

*Once these forms are completed, group discussions are held with the department heads and the information is submitted to the unit's human resources department. Again, focus is on the number of women and minorities designated as promotable and the development opportunities outlined for them.*

*Once department heads complete the forms, they submit them to the unit's human resources department and the senior vice president in charge of the unit for review. Again, special attention is paid to the number of women and minorities designated as promotable and the development opportunities outlined for them.*

*The information from the forms is then entered into a database, combined with the information from the other units, and sent to the corporate office for review and inclusion in senior-level succession planning. "This way, senior management is able to see and draw from a much greater pool of candidates, and the emphasis on women and minorities ensures that individuals who might have gone unnoticed before are now included," says Korske.*

## *Conclusion*

**“If sufficient numbers of Americans are not available, the work of these professionals will be sent overseas. Shortages will occur sometime in the future if the potential pool of future scientists and engineers is not enlarged.”**

*Executive Director of the Commission on Professionals in Science and Technology*

Highly skilled scientists and engineers are vital to America's economic strength, security and quality of life. However, women's career advancement in this field is stymied by a number of remediable barriers. Female engineers employed within corporations are inhibited from achieving their full potential. By more fully utilizing women, companies can avail themselves of a much-needed source of talent.

Examples of model programs and practices to make the field of engineering more attractive to women abound, as shown in this report. Catalyst urges employers to look to these initiatives for inspiration and for evidence that positive change can occur, and to customize and adopt them for use in their own workplaces. We encourage interested readers to contact Catalyst for more information about the highlighted programs.

# *Acknowledgements*

The staff of Catalyst conceived and executed the research, writing and editing of this report. Mary Mattis, Ph.D., Vice President of Research, designed and directed the research, which was ably carried out by Julie Harris, Parisa Mostafavee, Emma Sabin, Christine Scordato, Amy Segal and Marion Yuen. Further acknowledgement goes to both Julie Harris and Parisa Mostafavee for managing the earlier phases of the project on a day-to-day basis. Additional recognition goes to Marion Yuen, Amy Segal, Emma Sabin, Dana Epley and Jennifer Wynn for analyzing and interpreting the data and writing the report. Special thanks go to Debra Scheinholtz, Jennifer Wynn, Adriane Schwartz and Jennifer Colman for their editorial and production assistance, under the direction of Leslie Levin, Vice President of Marketing, and to Gloria Markfield, Executive Vice President, for her ongoing guidance and commitment to this research project. We owe a great deal to Felice Schwartz, President of Catalyst, for her vision and understanding of the unique issues female engineers face and her continuous support and encouragement of this research effort.

The staff of the Catalyst Information Center—Wendy Hirschberg, Anne Tierney, Stasha Hughes, Sandra McNeill and Suzanne Huber—was enormously helpful in assisting the research team in identifying resources. The support provided by Dana Epley, Suzanne Huber, Toni Odom, Jennifer Lucas, Linda Hirst, and Emma Sabin during the course of the study was invaluable in handling travel and meeting arrangements, setting up company visits, and designing the report. Our appreciation also goes to Janet Andre and Tatyana Doughty for their guidance on the research and to Eun Choi, for her work as a summer intern inputting and analyzing all of the statistical data.

We extend our gratitude to the 30 companies that participated in the research, particularly those that opened their doors to us and allowed us to interview their engineers and managers. Additional thanks go to the 220 participants—female and male engineers and managers—who gave their time to participate in focus groups and interviews and made this research possible. We also want to recognize the human resources professionals in the companies for their valuable feedback, insight and time, particularly those who attended the roundtable and strategy sessions:

David Baron, Manager, Human Resources, Engine Technical Center, Navistar International Transport Corporation; Kathryn Brown, Consolidated Edison; Karen Clary, Director, Corporate Human Resources, Cray Research, Inc.; Gregory Davis, Manager, Professional Employment & Organization, Texaco, Inc.; Patricia Davis, Manager, Human Resources, Chemical Waste Management, Inc.; Teresa DiStefano, Recruiting Specialist,

The Upjohn Company; Kathy Duggan, Manager, Human Resources, General Electric; Vincent Frankel, Consolidated Edison; Irwin Ginsburg, Consultant, Merit Company; Tamira Griffin, Corporate EEO & AAP Manager, Texas Instruments; Nancy Harrington, Manager, Quality and Safety Engineering, Mattel, Inc.; Derek Harvey, Manager, Planning & Administration, Mobil Corporation; Lynette Higgins, Consolidated Edison; Melanie Horneck, Senior Technical Associate, Colgate-Palmolive Company; Patricia Hughes, Director, Organizational Development & Training, Carnation; Rebecca Hyde, Director of University Recruiting, Hoechst-Celanese Corporation; Wendy Lawson, Manager, Corporate Organization Development, Martin Marietta; Cindy Mascone, Technical Editor, *Chemical Engineering Progress*; Barbara McDonnell, Manager of Recruiting, Matsushita Electric Corporation of America; Susan Michener, Manager, Human Resources Development, Texaco, Inc.; Rodney Nathan, College Relations Representative, Tenneco Gas; Lavonne Pelisari, Work Force Diversity Consultant, Sun Refining and Marketing Company; Francine Riley, Director, Workforce Diversity & College Recruiting Program, GTE; Connie Rose, Manager, Corporate Recruiting, AT&T; Cyndy Rosenbloom, Manager, Human Resources, Monsanto Agricultural Company; Allison Schieli, Human Resource Representative, Ebasco Services, Inc.; Rosa Schmidt, O.D. Specialist, Public Service Electric & Gas Company; Rita Shellenberger, U.S. Manager of Diversity, The Dow Chemical Company; Jean Spence, Director of Diversity Management, General Foods; Sherry Stripling, Manager of Engineering Personnel Services, General Dynamics Corporation; Stella Studderth, Senior Staff Mechanical Engineer, Flatrolled Products System, Alcoa; Barbara J. Thomas, Ph.D., Senior Research Scientist, Colgate-Palmolive Company; Patricia Todd, Human Resources Representative, Honeywell; Janice Vrabec, Employee Relations Supervisor, Alcoa; Connie Wharton, Managing Diversity, Texas Instruments; Phillip White, Group Manager, Associate Development Programs, GTE; Jerome Winchinsky, Manager, Professional Employment, BASF Corporation.

Finally, the project would not have been possible without the generous funding provided by AT&T Foundation, 3M Company, Motorola, Texaco Foundation, the Westinghouse Foundation, and BASF Corporation.

# *Research Participants*

The following companies participated in Catalyst's research on women in engineering:

Alcoa	Kraft General Foods
Amoco Chemical Company	Martin Marietta
AT&T	Matsushita Electric Corporation
BASF Corporation	Mattel, Inc.
Chemical Waste Management, Inc.	Mobil Corporation
Colgate-Palmolive Company	Monsanto Agricultural Company
Consolidated Edison	Navistar International Transport Corporation
Cray Research, Inc.	Nestlé
Dow Chemical Company	Public Service Electric & Gas Company
Ebasco Services, Inc.	Sun Refining and Marketing Company
General Dynamics Corporation	Tenneco Gas
General Electric	Texaco, Inc.
GTE	Texas Instruments
Hoechst-Celanese Corporation	The Upjohn Company
Honeywell, Inc.	

One participating company chose not to be listed.



# *External Networking Organizations*

**The Society of Women Engineers (SWE – Membership 15,000)** is a non-profit educational service organization of graduate engineers and women and men with equivalent engineering experience. Through conferences, conventions, university sections and junior high school mentoring programs, SWE informs young women, their parents, counselors and the general public of the qualifications and achievements of women engineers and the opportunities open to them; assists women engineers in readying themselves for a return to active work after temporary retirement; and encourages women engineers to attain high levels of education and professional achievement. Contact: Society of Women Engineers, 343 E. 47th St., New York, NY 10017 (212) 705-7855.

**Women in Engineering Program Advocates Network (WEPAN – Membership 355)** was founded in order to increase the number of young women who pursue careers in engineering by encouraging the initiation and expansion of Women in Engineering Programs at colleges and universities throughout the United States. Contact: WEPAN Member Services, 1284 Civil Engineering Building, Room G29 3A, Purdue University, West Lafayette, IN 47907-1284 (317) 494-5387.

**American Association of University Women (AAUW – Membership 140,000)** works for the advancement of women through advocacy and emphasis on life-long learning. The association also engages in research, lobbies, sponsors competitions, bestows awards and maintains a library and an archive. Contact: AAUW, 1111 16th Street N.W., Washington, DC 20037 (202) 785-7700.

**American Institute of Chemical Engineers (AIChE – Membership 55,000)** establishes standards for chemical engineering curricula and offers employment services. The institute also sponsors petrochemical and refining, exposition and continuing education programs, sponsors competitions, bestows 16 awards, offers placement services and a speakers bureau, and compiles statistics on the chemical engineering work force. The AIChE's Professional Development Committee has a Women and Minority Subcommittee. Ten percent of all AIChE's members are women. The subcommittee has published "Guidelines on People-Related Employment Issues," addressed to employers of engineers, which recommends policies and practices on employment conditions, professional development and dependent care. The subcommittee is developing a number of exciting proposals to further address the issues facing female engineers. Contact: AIChE, 345 East 47th St., NY, NY 10017 (212) 705-7326.

**National Society of Professional Engineers (NSPE – Membership 75,000)** members are registered engineers from a range of fields and interests. The NSPE is concerned with social, professional, ethical, and economic considerations of engineering as a profession. It encompasses programs in public relations, employment practices, ethical considerations, education and career guidance. The society also monitors legislative and regulatory actions of interest to the engineering profession. Its task force on women seeks to help female engineers establish a level playing field within corporations and to help them promote themselves. They hope to do this by gathering information on the issues from a broad range of sources and by looking at the attitudes and assumptions about women. Contact: NSPE, 1420 King St., Alexandria, VA 22314 (703) 684-2800.

**Association of Women in Sciences (AWIS – Membership 3,500)** members are professional women and students in life, physical and social sciences and engineering; men are also members. The Association promotes equal opportunities for women to enter the science profession and to achieve their career goals; provides educational information to women planning careers in science; networks with other women's groups; monitors scientific legislation and the status of women in science. The association also provides advice and support to women involved in equal opportunity legislation, assists local chapters with programming and support services, and operates AWIS Educational Foundation, which awards six \$500 scholarships annually for predoctoral study and promotes appreciation of accomplishments of female scientists. Contact: AWIS, 1522 K. St. N.W., Suite 820, Washington, DC, 20005, (202) 408-0742.

**National Society of Black Engineers (NSBE – Membership 6,600)** seeks to increase the number of minority graduates in engineering and technology by bestowing awards and sponsoring seminars and workshops to prepare students for careers in the industry and leadership roles. Contact: NSBE, 344 Commerce St., Alexandria, VA 22314 (703) 549-2207.

**Society of Hispanic Professional Engineers (SHPE – Membership 6,000)** Members are engineers, student engineers and scientists seeking to increase the number of Hispanic engineers by providing motivation and support to students. The society sponsors the Society of Hispanic Professional Engineers Foundation, bestows awards and maintains a placement service and a speakers bureau. Contact: SHPE, 5400 E. Olympic Blvd., Suite 225, Los Angeles, CA 90022 (213) 725-3970.

# References

Baco, Eleanor. *Salaries of Scientists, Engineers and Technicians: A Summary of Salary Surveys*. Commission on Professionals in Science and Technology, Washington, DC, August 1991.

Baum, Dr. Eleanor, Dean. *The Cooper Union 1989 National Survey on Working Women Engineers*. The Cooper Union for the Advancement of Science and Art, New York, 1989.

Bureau of Labor Statistics. *Current Population Survey*. U.S. Department of Labor, Washington, DC, 1990.

Bureau of Labor Statistics. *Occupational Outlook Quarterly*. U.S. Department of Labor, Washington, DC, Fall 1991.

Bureau of Labor Statistics, 1991 (unpublished).

Capece, Susan. *Challenges & Achievements: A Celebration of Women in Engineering*. Penn State Conference, 1991 (unpublished).

Eng, Pat & R.A. Ellis. *A Pilot Survey of Men and Women Engineers*. Engineering Manpower Bulletin. Published by the Engineering Manpower Commission of the American Association of Engineering Societies. No. 107. January 1991.

Ellis, R.A. *Uncertainties & Problems Associated with Estimates of Labor Market Supply and Demand for Engineers and Scientists*. Testimony for the Hearings on Scientific and Engineering Manpower. Committee on Science, Space, and Technology, U.S. House of Representatives. Engineering Manpower Commission of the American Association of Engineering Societies. Washington, DC, 1991.

Engineering Manpower Commission. *Survey of Engineering and Technology Degrees*. American Association of Engineering Societies. Series through 1958-1991.

Fowler, Elizabeth M. "Careers: Improving Technology in Services," *New York Times*, September 24, 1991.

Girls Inc. *The Explorer's Pass: A Report on Case Studies of Girls and Math, Science and Technology*. Operation Smart Research Project. IN, 1991.

Minnesota Historical Society. *Her Works Praise Her: Inventions by Women*. Traveling Exhibits. St. Paul, MN.

National Science Foundation. *Selected Data on Science & Engineering Doctoral Awards: 1990, NSF 91-310*. Washington, DC, 1991.

National Science Foundation. *1990 Biennial NSF Report on Women and Minorities in Science & Engineering*. Washington, DC, 1990.

Shinberg, Diane. *Women in Engineering*. Engineering Manpower Bulletin. Published by the Engineering Manpower Commission of the American Association of Engineering Societies. No.'s 109 & 118. May 1991, 1992.

U.S. Department of Commerce. *Buttons to Biotech: U.S. Patenting for Women: 1977-1988*. Patent and Trademark Office, Office of Documentation Information, Technology Assessment & Forecast Program, Washington, DC, January 1990.

U.S. Department of Labor. *Report on the Glass Ceiling Initiative*. Washington, DC, 1991

Vetter, Betty. *Women in Science and Engineering: An Illustrated Progress Report*. Commission of Professional in Science and Technology, Washington DC, December 1990.

Wellesley College Center for Research on Women. *The AAUW Report: How Schools Shortchange Girls*. Washington, DC: American Association of University Women, 1992.

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