



Women in Microwaves

Let's Keep Women in Microwaves (But Let's Turn Down the Heat!)

■ Kate A. Remley

It is well documented that after 10 years or so into science, technology, engineering, and math (STEM) careers, many women leave their jobs and/or the field in numbers that are disproportionate to those of men (see [1]–[4] and the references therein). In fact, roughly 40% of women engineers end up leaving the profession after a decade or so [1], [2]. The reasons for this “fight or flight” moment when so many women choose flight over staying on to fight for more satisfactory STEM careers are many, but companies and organizations are starting to address this effect, with the goal of retaining this highly trained and dedicated sector of their staff. According to the 10-year-old study of [1], “Cutting female attrition by 25% would add 220,000 highly qualified women to the SET talent pool.” (The “SET” acronym for “science, engineering, and technology” predates STEM.)

As a practicing female electrical engineer, I am extremely interested

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in this subject. In preparing this article, I was surprised to find out how pervasive this fight or flight moment is, and I was encouraged to see that many companies and organizations (including Women in Microwaves!) are taking steps to address this issue.

The Scissors Effect

All engineers train hard to work in their professions. However, at least in the United States, women engineering students have faced additional challenges due to the perception of fellow students, professors, and the public that females are less competent. But there are hopeful signs that this is changing in the United States, as it has already changed in many other parts of the world. In [1], the notion that women are inherently less well suited to be engineers has been found to be geographical. For example, there is a saying in China that “women hold up half of the sky.” And I recall a fellow female graduate engineering student from Spain telling me that, after government initiatives were put in place, fully half of the electrical engineering students in her university



were female. At any rate, many females who graduate from electrical engineering programs already expect some adversity in their chosen career, and so their mid-career departure from the field is surprising.

In the United States (and I suspect many other countries), women “hit a wall” in their mid-to-late 30s when they are becoming well-established members of the engineering staff.

Focus on WiM: Kate Remley



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They often transition (or are encouraged to transition) toward project or team management, which is sometimes seen as “merely ‘peripheral’ to the real, technical work” [3]. Managerial roles also expose women to the realities of workplace politics, which can be surprisingly troublesome, especially without mentors or a road map to guide their progress. At the same time, many 30-something women start families, and their elder-care responsibilities also increase, although [3] and [4] both found that family factors do not account for the differential loss of women in STEM occupations, compared to other professional occupations.

Rather, isolation, including a lack of mentors in support roles, and the subtle message that their work is not as valued as that of their male counterparts factor into the lack of retention raised time after time in these studies. The result? In STEM occupations, a so-called scissors effect [1], “the falling away of women (and the ascendancy of men) is particularly steep and sharp.”

What to Do?

A 2017 study by Fouad et al. [2] of 1,464 female engineers who left the profession concluded that

the top three sets of reasons underlying women’s decision to leave the jobs and engineering field were related to: first, poor and/or inequitable compensation, poor working conditions, inflexible and demanding work environment that made work-family balance difficult; second, unmet achievement needs that reflected a dissatisfaction with effective utilization of their math and science skills; and, third, unmet needs with regard to lack of recognition at work and adequate opportunities for advancement.

This list sounds daunting to overcome. However, there are a number of specific actions that organizations are taking to reduce these unmet needs to retain more women in STEM occupations. Here are some examples.

Flexibility and Support for Work–Life Balance

Fouad et al. [2] found that *comfort*, defined as “needs related to activity, independence, variety, compensation, security and working conditions,” was by far the largest reason that women engineers left their jobs and/or the field. They further found that “within the Comfort category of values, and the ‘working conditions’ set of needs,

those relating to work life imbalance stood out in their frequency.” Many women reported that the engineering job was a busy one, to the point that it impacted their work–life balance. Many women reported that engineering jobs could be very demanding and that their employers expected them to commit more than 40 h per week. Also, “Many women engineers specifically mentioned a concern with the possibility of a glass ceiling and stated that they were not paid equally compared to their male counterparts” at the same skill level.

To counteract these issues, many companies are adopting flexible schedules, accommodating the needs of women (and men) who care for family members, including children and elder care. Telecommuting also offers a way to support staff who need to take care of family members but are still able to contribute from an alternate work site. Where I work, we have “family-friendly sick leave” and a strong telecommuting program that allows our mid-career staff, female and male, to prioritize family issues as much as possible. I am sure that many companies have even more creative solutions to these problems that would help to retain women employees.

Other Techniques to Retain Women Engineers (Abridged From [1])

- *Expanding recruitment:* Student mentoring programs look to science, technology, engineering, and math losses among science, engineering, and technology (SET) female graduate students. Some companies are striving to “widen the filters” to attract top-notch individuals who may not have technical credentials.
- *Targeting technical roles:* Technical leadership programs for women can help to position female engineers to advance to higher levels. Some companies have implemented telepresence coaching to permit more effective mentoring of key female talent.
- *Creating on-ramps for women who have taken time out:* Companies are developing programs designed to attract highly qualified SET women who have taken time out from their careers. One institution’s Midcareer Acceleration Professional Development Program is specifically designed to reintroduce off-ramped SET talent.
- *Fighting isolation:* Some companies are changing things at the top by hiring a significant number of senior women at the vice president level and above and providing support for successful assimilation.
- *Harnessing altruism:* Survey data show that 55% of female scientists entered their field to better humankind, and fully 63% consider contributing to the well-being of society a motivating factor in their choice of career (considerably more important than compensation). Including altruistic programs and activities, and allowing time to participate, resonates with many female engineers.

Importance of Changing Perceptions, Critical Mass, and Supportive Management

While improved flexibility in scheduling seems like a straightforward solution to the fight or flight moment, accounting for the differences in attrition between STEM women and those in other professional occupations requires more than work-life amenities. According to [4],

We suspect that the retention deficit in STEM may be due to the team organization of scientific work combined with the attitudes and expectations of coworkers and supervisors who hold more traditional beliefs about the competencies of women in these rapidly changing fields. The token status of women at higher skill levels, which we could not test, may also contribute to their disproportionate loss compared to skilled professionals.

For this, the importance of supportive management practices that encourage women engineers while refusing to allow dismissive comments and/or practices is critical, because it is senior leadership that sets the “tone at the top” [1].

The data show that including more women in engineering management

can help to stem the tide of women leaving STEM fields. As noted in [1], “Although other researchers have shown that the tipping point is 20%, our research finds that SET fields are so male dominated that a mere 10% of women in management makes a critical difference.” Also, many companies are realizing that intergenerational experience and mentoring helps to reduce the feelings of isolation that many women experience in environments where they are the only, or one of a very few, women. As pointed out in [1], “Creating links across this great divide would be particularly valuable for women ages 35–40, when many of them are deciding whether to fight or flee.” This seems like a relatively easy fix, provided senior women and female managers can be encouraged to stay!

Recognition

“Lack of recognition was another factor that pushed women out of the engineering field,” according to the Fouad et al. study [2]:

It appears that some women did not feel they were being respected or received enough recognition in their work. For instance, one woman commented, “I could

expect very little recognition, both financially and organizationally.” Similarly, another participant stated that people often told her that she “had to work twice as hard to get half the recognition.” In addition, one of the participants stated, “Excellence in engineering is not rewarded with promotions, raises, or even appropriate recognition.”

Recognition also includes understanding that people have various skill sets and are not “assets” to be assigned to a task without regard for individual strengths and weaknesses. The authors of [1] give an example of a successful biotech company that does a great job of attracting and retaining female employees:

One reason the company retains female talent is that managers recognize when a skilled person is not being used to her full potential. As one senior-level woman puts it, “If we see someone who is not performing well because she is a square peg in a round hole—but is very talented—we find a square hole.”

This has been a strategy that I, too, have used over the years with good success, getting the work done with

the best fit for researchers, although this has sometimes led to a more complicated organizational chart. (For further discussion, see “Other Techniques to Retain Women Engineers.”)

Conclusion

As the research shows, historically there have been many reasons that women leave the engineering field. Organizations are finding that some of the reasons are relatively straightforward to address with amenities like flexible hours and leave schedules. Other issues may take more creativity and time to overcome. Many of the initiatives put in place by supportive professional societies like the IEEE Microwave Theory and Techniques Society can go a long way to promote fairness and respect, key professional at-

tributes that will encourage women to stay in STEM careers.

For example, the review process of our journals and conferences is oriented in a good direction: a key part of this process is getting multiple independent judges to perform reviews. While one reviewer may have a bias, chances of a biased review swaying the results get smaller and smaller with a larger number of reviewers. As engineers, we are problem solvers. Hopefully, companies will continue to move forward with data-backed initiatives to retain women engineers. And, as the numbers grow, so will fairness and respect.

Acknowledgment

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Microwave Surfing *(continued from page 10)*

the link to [4], considered the hypothesized “microwave oven” description farfetched. When one takes into account the large distances involved between satellite antennas and ground-based systems and the relatively low maximum power available to spaceborne transmitters, I tend to agree with him. However, a hacked satellite antenna may conceivably pose a threat to some sensitive electronic systems.

How can we protect the security of the existing space-based communication and navigation infrastructure? According to a report [2], China recently launched the world’s first “quantum communications satellite.” Such a system could be the closest thing to being tamper-proof. As Gregoir Ribordy, co-founder of the quantum cryptography company ID Quantique, explained [2], “Quantum entanglement is sort of like sending a message in a soap bubble. If

the wrong person pops it, the message will go away.”

On the global scene, David Livingstone of Chatham House, an international affairs think tank, argued in a report [2] that we need an “international space and cybersecurity regime” of a “limited number of able states and other critical stakeholders” to “provide a vehicle for practical leadership in delivering enhanced security within the whole of the global space sector.”

In contrast, U.S. Vice President Mike Pence announced recently [1], Just as in the past, when we created the Air Force, establishing the Space Force is an idea whose time has come. The space environment has fundamentally changed in the last generation; what was once peaceful and uncontested is now crowded and adversarial.

Against this backdrop, it is anybody’s guess what the prospects of Livingstone’s proposed “international space and cybersecurity regime” are.

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