With the rest of her family, Betty Anderson relaxes in the living room of her comfortable "home," on the set of the popular sitcom, "Father Knows Best." In episode 30 of the show’s second season, Betty decides to study engineering. Due to the push back she receives from everyone, especially the "boy engineer" assigned to train her on the surveying equipment, she succumbs to their expectations of appropriate "feminine" roles.
A 1956 episode of “Father Knows Best,” a popular family comedy, is a powerful reminder not only of the pervasive cultural norms of that era, but also of their subtle variations that continue today.

By Meredith Holmes, SWE Contributor
In "Betty, Girl Engineer," Betty Anderson, the bright, energetic teenage daughter in an iconic, mid-20th century American family, signs up to work on a surveying crew because she wants to be an engineer. Her father says the math is too hard; her mother says girls don’t belong on a field crew; and her little sister calls her a “mixed-up kid.” Being a teenager, Betty resists her family’s objections, but her field crew supervisor ultimately wins the war on her aspirations. He’s a handsome college engineering student who lectures her relentlessly about her “proper place” as a woman (in the kitchen, wearing a dress) and never gets around to showing her how to operate the surveying equipment. In the end, Betty changes out of her jeans and into a dress and agrees to date the boy engineer.

When the show first aired, members of SWE’s Pacific Northwest Section were so outraged, they organized a letter-writing campaign to CBS headquarters in New York. (See May 1956 newsletter, pg. 5.) Screened at the SWE annual conference in 2009 and in 2010 as part of the 60th anniversary gallery exhibit, "Betty, Girl Engineer" shocked and offended a whole new generation of engineering students and young engineering professionals. Although a lot has changed since the mid-1950s, the problem of gender bias still seems to resonate with women engineers, and several SWE sections are planning to hold screenings of “Betty, Girl Engineer” followed by discussions.

Unpacking a sitcom
“Betty, Girl Engineer” vividly illustrates the mores of the 1950s, but that’s only part of the story. To understand the whole story requires history, a systematic examination of social forces that drive the attitudes expressed by the characters in the show. Initially, it does not occur to Betty Anderson that she will encounter any obstacles to becoming an engineer. That’s the American dream: Decide what you want to be, and then work hard to realize your ambitions. But Betty lives in interesting and contradictory times. Just 15 years earlier, during the war years (1941 to 1945), in a nationwide propaganda campaign by both government and industry, many women college students with math and science ability were recruited and trained to fill technical positions in defense plants. But women’s technical contributions so crucial in wartime became superfluous in peacetime, and the “engineering aides,” along with most of the female war effort workforce, were the target of a second, equally vigorous propaganda campaign to leave their jobs and become full-time homemakers.

Under the heading of “Father Does Not Know Best,” an article in the Society’s May 1956 newsletter encourages members across the country to follow the lead of the Pacific Northwest Section to protest the episode. Newsletter editor Emma C. Barth wrote: “Let the producers and sponsors know that women engineers are not freaks and objects of ridicule. The shortage of engineers is no laughing matter.” Note that the article refers to the NBC network; this was because the show began on NBC radio, then moved to CBS television; it moved back to NBC, and again to CBS, and was eventually shown on all three networks.

“Then” and “Now”

Many changes took place in American society in the decades that followed the run of the CBS popular family sitcom from the 1950s, “Father Knows Best.” The “Betty, Girl Engineer” episode, which aired April 11, 1956, focused on teenage Betty’s desire to study engineering, and the subsequent berating she experienced. Rather than offering a critique of the social norms that framed Betty’s experience, the show portrayed Betty as the one at odds with the world, who needed to come to her senses.

In 2005, nearly 50 years later, three middle school students from Baton Rouge, La., were among the teams that participated in the National Engineers Week Future City Competition™. This all-girl team, Lauren Arikol, Lisa Lynch, and Kathleen O’Harra, students at St. Thomas More School, entered their design, “L’Etoile Directrice.” They progressed to the finals in Washington, D.C., where they became national champions, winning over 32 other regional finalists. In contrast to Betty Anderson, who was rebuked for her aspirations, civic pride in the girls’ accomplishment was such that a billboard was put up to honor them.

— A.P.
In the introduction to the second volume of her three-volume series, Women Scientists in America, Margaret Rossiter, Ph.D., describes how, in the 1950s and early 1960s, a period of great affluence when scientists and technicians were in demand to fight the Cold War, and record numbers of women had science and technical training—women were shut out of science and their professional aspirations ridiculed. She writes:

“Unfortunately for the trained women of the 1940s through the 1960s, the evidence indicates that the growth and affluence of the period that could have made room for more and better-trained scientists of both sexes did not benefit the two equally; in fact, it generally unleashed certain forces that hastened the women’s exit and subsequent marginalization and underutilization, which could then be cited to justify denying further training to their successors.”

One of these forces was a push in the post-war period by many colleges, especially the state colleges, teachers’ colleges, and colleges of home economics that had employed many women, to rebrand themselves as prestigious and to “masculinize” departments where women were numerous or visible. Schools were renamed, salaries increased, more Ph.D.s hired, and research strongly encouraged. Older women faculty were retired, and younger women were not hired. Women faculty who managed to hold onto their positions were marginalized, often finding it difficult to get credit for their work and to receive tenure. (Ruth Oldenziel, Ph.D., explores the history of this process in American society as a whole in her book, Making Technology Masculine: Men, Women, and Modern Machines in America 1870-1945.) Anti-nepotism rules were reinstated at many colleges and universities. These rules prevented married couples from working at the same institution, effectively removing women from the faculty.

Dr. Rossiter points out, “Thus, at a time when young male scientists faced enhanced opportunities at every turn,
the young women were supposed to be at home with the children, whether they had them or not or whether they wanted to be there or not.” Betty Anderson had absorbed the message sent to women in the early 1940s: With talent and hard work you can accomplish anything, and your contributions will be valued. But she hadn’t reckoned on and couldn’t fight what Rossiter calls the “juggernaut” of exclusion from professional employment.

A different story

As illuminating as Dr. Rossiter’s research is, shedding new light on feminism, U.S. employment policy, and the role of science in an industrial society, gender parity in engineering has its own distinct narrative. Amy Bix, Ph.D., is a science historian who specializes in the history of women in engineering. She is associate professor of history and director of the Center for Historical Studies of Technology and Science at Iowa State University. She is the author of many books and articles about the history of technology, U.S. science policy, and women in science and medicine.

Dr. Bix is working on a history of engineering education for women, due out later this year, entitled Girls Coming to Tech! A History of Engineering Education for American Women. She decided to focus on engineering education because it is “the gateway” to the profession. “It’s where the big questions are asked,” she said. “Are women going to be allowed into engineering? If so, on what terms? If not, why not?” Dr. Bix is taking a close look at four all-male engineering schools — Georgia Tech, Cal Tech, Rensselaer Polytechnic Institute (RPI), and MIT — that decided, under pressure from various interests, to admit women. (MIT had admitted women since 1870, but into the 1960s and beyond, remained, in effect, a male bastion.)

The impetus for the book arose from her experience teaching a class in the history of women in science, technology, and medicine at Iowa State. “When I started teaching the class almost 20 years ago, there wasn’t any problem finding materials for my students to read about the history of women in science,” Dr. Bix said. “There was Rossiter’s work, and plenty of books and articles about the history of women in medicine. But I literally couldn’t find anything for my students to read on the history of women in engineering. At first I said, ‘Oh, well, I’ll just work around it.’ The second time I taught the course, I still couldn’t find anything, and I said, ‘This is getting annoying!’ And finally I said, ‘Well if nobody else is going to write an academic history of women in engineering, maybe I’ll do it myself.’”

A turning point

Research for her book, which covers from the mid-1800s to the present, eventually brought Dr. Bix to WWII, which she describes as a “turning point.” “We’ve all heard of Rosie the Riveter, but what’s not talked about enough is that women also worked in wartime plant engineering shops,” said Dr. Bix. Big corporations, including General Electric and Curtiss Wright, recruited women with math and science ability to apply for intensive engineering training. The Curtiss-Wright Cadettes, for example, received their engineering education on the campuses of seven participating universities: Cornell, Purdue, Penn State, University of Minnesota, University of Texas, RPI, and Iowa State College. (Note: See Journal of the Society of Women Engineers, 60th Anniversary Edition, “Curtiss-Wright Engineering Cadettes, 21st Century Questions and Issues,” p.22-35. http://www.nxtbook.com/nxtbooks/swe/60thanniversary/#/24).

Dr. Bix acknowledged, “Most of the women who went into engineering during World War II didn’t make it a lifetime career. Either by choice or necessity, they went on to other things after the war.” But the campus experience, if not the engineering shop work experience, changed women’s lives, their expectations, and their views of themselves. “This is the first time you get a critical mass of women engineering students,” Dr. Bix said. “At schools like Purdue, there are enough women engineering students that they can get on the engineering student council, and the women notice the effect of the critical mass. They say, ‘People don’t stare at us any more because we’re women carrying a slide rule.’”

In addition, some schools — RPI, for one — that admitted women during the war on a kind of emergency basis, continued to admit them after the war was over, never returning to their all-male status. Although meaningful coeducation at schools that specialized in engineering education did not occur until much later, the lowering of a few formal barriers like this signaled that World War II had set in motion some changes that could not be reversed.

Tough to break in

As a historian, Dr. Bix is intrigued by the question of why the participation of women in engineering lags that of medicine and the sciences. “It’s definitely not an error of perception,” she said. “Engineering stands out, if you look at the figures collected by the U.S. Department of Education on all academic scientific disciplines, as the most gender-imbalanced of them all.”

Historians, including Dr. Rossiter, have documented women’s long history of “infiltrating” some areas of science. “Even when women weren’t supposed to do science,” Dr. Bix explained, “in upper-class European and later in upper-class American society, girls
learned botany because flowers were appropriately feminine and because it was good discipline for the mind.” And, in the 18th and 19th centuries, some corners of medicine were friendly to women even when the mainstream paths were blocked. “Engineering, however, was much more difficult for women to infiltrate,” said Dr. Bix. “Historically, people who did technical work and engineering did not need technical degrees. In the 19th and early 20th centuries, the men who built railroads, worked in machine shops, and built the Erie Canal learned on the job. It was virtually impossible for women to get this kind of hands-on experience.” Additionally, in the 19th century, the prominent women’s colleges like Vassar, Smith, and Mount Holyoke did not offer courses in engineering but did graduate many women with degrees in chemistry, biology, physics, and astronomy. In fact, Smith is the only one of these women’s colleges to offer an engineering degree, beginning its engineering program in 2000.

Subtle barriers, hidden bias
The data showing gender disparity in engineering are not subtle, but the cause remains elusive, maybe because gender bias in employment and education has gone underground. If a parent or teacher or guidance counselor says, “You can’t be an engineer because you’re a girl,” it’s obviously untrue. You can counter with statistics, cite EEO law, and show that there are thousands of highly accomplished women engineers. “But if it’s more subtle than that,” Dr. Bix said, “if you’re dealing with what sociologists have called a ‘chilly climate’ — sexist jokes, not being taken seriously — and what some women at MIT have termed ‘micro-discrimination,’ that’s much harder to fight.”

Betty Anderson was definitely on to something when she used only her initials on the application for the high school job-training program. She needed to conceal the fact that she was a girl, and unfortunately, if she were applying for a science lab manager position at a university today, she would still be better off using “BJ” than “Betty.” A 2012 study conducted by researchers at Yale found unconscious bias of both male and female faculty against female students. In the study, 127 biology, chemistry, and physics faculty from three private and three public, research-intensive universities rated resumes of recent graduates applying for a job as a science lab manager. The resumes, which were identical, were randomly assigned a male or female name. Faculty participants rated female applicants as less competent than male applicants and were less likely to hire them or offer them mentoring. Faculty willing to hire female applicants offered them lower starting salaries than male applicants ($826,508 versus $30,328). The findings of the study are significant because undergraduates considering graduate school and applying for research jobs are at a pivotal point in their lives. Bias or lack of support from a faculty member could discourage them from pursuing a career in science.

Taking the long view
On the other hand, it’s also useful to acknowledge how much things have changed for women in engineering. “It is absolutely amazing when you look at large state schools, as well as small private schools all around the country, to see the incredible support mechanisms for women in science and engineering,” Dr. Bix said. This includes formal organizations like SWE, mentoring programs, residential colleges, guest speakers, and informal extracurricular activities. Dr. Bix also regards the growth of the support system — websites, toys, and organizations like the Girl Scouts and SWE — that encourages girls to think about an engineering education or career as an important development.

“Here at Iowa State, we are about to get a female engineering dean,” Dr. Bix said. “A number of years ago, this would have been headline news. Now there are enough women engineering deans that, while it is worthy of note, it is not strange and unique. It’s regarded as entirely mainstream. This, along with the many women who have made careers for themselves in engineering, is a tremendous accomplishment.”

Gender Issues in Engineering: A World View

It’s an eye-opener to compare the history of women in engineering in the United States with that of women in other countries. Progress for American women engineers since the 1960s can be attributed to the larger feminist movement, individual activists, and organizations like SWE. Social influences vary widely from country to country, however, and the history of women in engineering is very different, even in cultures we think of as similar to our own, such as Great Britain and France. As science and engineering historian Amy Bix, Ph.D., has pointed out, “It’s important to keep in mind the broader cultural gender issues and to remember that the United States is just one setting for women in engineering.”


The first article, “Multiple-entry Visas: Gender and Engineering in the U.S., 1870-1945,” by Dr. Oldenziel, looks at class, kinship, and education in the engineering profession and includes archival material about SWE. “Am I a Lady or an Engineer?” examines the origins of the Women’s Engineering Society in Britain. Other chapters cover women engineers in East Germany during the Cold War; how Greek women entered the profession; and engineering education in France, Sweden, and pre-revolutionary Russia.