

**Making a World of Difference  
Recruitment of Undergraduate Students at USU**

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**Abstract**

This paper describes two creative methods that are used to recruit undergraduate students at Utah State University. The first is "Engineering State", a four-day hands-on immersion in a wide array of engineering disciplines, and the second is a slide show called "Making a World of Difference – Women in Engineering" that was created by a woman engineering student to provide an uplifting, upbeat look at the difference a woman can make in the world if she becomes an engineer, and to encourage young women to take a second look at the opportunities engineering presents for them. The Engineering State program has been in place since 1992 and has had clear, measurable benefits in the recruitment of students to USU engineering programs. One of the goals of Engineering State is to attract women and minorities to consider an engineering career. The engineering students who have seen the preliminary portions of the new slide show have excited comments, smiles on their faces, and a renewed positive outlook. It is hoped that this exposure will provide much-needed role models, success stories, and a new look at engineering as the people-oriented profession that it can be. This slide show is available free to interested faculty, and is downloadable in Power Point format from the web.

**Introduction**

The college of engineering at Utah State University is composed of departments of electrical and computer engineering, biological and irrigation engineering, civil and environmental engineering, mechanical and aerospace engineering, and industrial technology and education. It collectively graduates approximately 280 undergraduate students and 100 graduate students a year. Many of these students are foreign nationals, and most of the others come from Utah and its neighboring states. 10 % of these students are women.

There are two goals of the undergraduate recruitment program. One is to familiarize high-quality high school students (dominantly from Utah and Idaho) with Utah State University and encourage them to consider it for their education, and the other is to familiarize them with engineering and its wide array of challenges. The engineering college also makes an active attempt to recruit women and minority students. Several programs throughout the year provide opportunities for students at all age levels to visit campus, but by far the largest outreach program of the college of engineering is "Engineering State". High school students who have completed their junior year and have high grade points or those identified by high school counselors as interested and motivated in math and science are invited to USU for four days of hands-on immersion in engineering.

The "Engineering State" program seeks as many young women as it can attract to come to campus, not just those who have stated an interest in engineering, but many who are well-prepared in math and science but have not really considered engineering as a career option. Many have pre-conceived notions about engineering being dull, machine-dominated work with little contact with people. These young women, like most Engineering State students, originally have very little idea what an engineer really does or the huge array of opportunities it presents. Many are unaware of the wide range of ways engineers work directly with and for people. A new slide show called "Making a World of Difference -- Women in Engineering" exposes women to the multi-faceted challenges that women engineers have worked on, are working on, and will be working on. It shows how engineering has the power to help them help others, how engineering can be and is very people-oriented, and how they, as engineers, could have the power to improve the world.

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## Engineering State

"Engineering State" adopts its name from "Boys State" and "Girls State" that provide high school students with a four-day resident "camp" atmosphere for a fun, intense learning experience. "Engineering State" targets local students (dominantly Utah and Idaho) who have the potential to succeed in engineering at Utah State University. Students active in math and science classes, most with high GPAs are targeted. They do not need to have specified an interest in engineering, and in many cases have not. In addition, students from under-privileged regions of the state and women are specifically targeted and given "scholarships" to make it easier for them to attend. Most of the "Engineering State" students are not well aware of what engineers do, and part of "Engineering State" is to acquaint them with what an engineer does. The only formal "assignment" of the experience is to interview an engineer and write a 1-3 page paper on what they do prior to coming to Engineering State. These interviews are discussed in group sessions, and students are often impressed and amazed at the range of projects that directly impact them that are done by local engineers. Students are also generally impressed by both the variety and the similarities of the engineering experiences. Aspects of engineering they expect commonly appear -- use of computers, tools, machines, mathematical calculations, and drafting, for instance. Other aspects appear that they often were not expecting -- extensive contact with people, working on teams, dealing with clients, writing and speaking, creative engineering expression, and a sincere interest in improving the world.

The key to making the "Engineering State" experience fun is to keep the students active and busy with fun and challenging hands-on engineering activities called "Challenge Sessions". They need to be just difficult enough to challenge but straight-forward enough that everyone can be successful. This is quite a challenge for the faculty to develop projects of great interest for the wide variety of skill levels of the students! Popular projects include an introduction to the net and interactive gaming, building a small electrical counter, testing paper aircraft in a wind tunnel, pop bottle rockets, bridge construction competition, and construction of a simple electromagnetic cannon. Each student participates in 12 Challenge Sessions.

The key element of "Engineering State" is FUN! This is held in early June, so outdoor activities, barbeques, games, contests, and an end-of-week dance are included for fun social activities. Students stay in the university dormitories, and are accompanied and chaperoned by USU engineering students, who are paid as TAs for this purpose. Engineering undergraduates and graduates also help with the student project sessions and group discussions. These student mentors provide an invaluable resource for "Engineering State" students to ask the many questions they might not ask faculty mentors (like "are the teachers nice here?").

In a specific attempt to attract women engineering students, many scholarships are provided to bring as many women to "Engineering State" as possible. In a typical year (1994), 209 men and 169 women attended Engineering State. To provide a specific recruiting opportunity to answer concerns of the women students, there is a special Womens' Program the Sunday evening prior to "Engineering State" where USU female engineering faculty and SWE members mingle with the women students and interested parents over dinner. Alumni speakers give their experiences in the field and discuss engineering school, career options and rewards, how to mix engineering and family, and resources available to incoming freshmen. At the beginning of the week most of the women attendees express initial lack of interest in engineering, in spite of being well-prepared in math and science. At the end of the week, many have learned of aspects of engineering that DO interest them and express possible interest in engineering as a career.

"Engineering State" is a very effective recruiting tool. Of 378 attendees (1994), 125 enrolled as freshmen at USU, 48 of whom chose engineering. Of these students, 53 women enrolled at USU, 8 of whom were women. It is difficult to measure how many of these would have chosen USU and engineering without the program. Personal contact with the students does indicate that many chose USU over other colleges, and engineering over physics or math, for instance. They feel comfortable on campus, familiar with the location and able to find their way around. They know the names of at least a few engineering faculty and staff and may come to them with questions. And they have met a few other students who also are incoming freshmen or upperclassmen. They are a little familiar with the different engineering disciplines and what engineers of all types do. Whether or not they choose to become engineers, they generally carry a new and positive impression of the effect engineers have on society.

#### Slide Show – Making a World of Difference

Women engineers in the past and present can provide valuable, inspirational mentors for today's female students. Their contributions to engineering advances have "made a world of difference." Here are a few of the engineers and their inventions that are highlighted in this slide show that have had lasting effects on the world as we know it today.

An observation that changed the ancient world was made by Ling-Chi Si (2640 B.C.), first Empress of China, when she developed a process to remove the silk thread from the cocoon of the silk worm and set up silk cultivation farms. [1]

Contributions to patents of others were common in the 18<sup>th</sup> century. These included key contributions made by Catherine Green to the invention of the working cotton gin that was later patented by Eli Whitney, and Sybilla Master's invention of a method for curing Indian corn that was patented by her husband, Thomas. The first patent granted to a woman was to Mary Kies in 1809 for a method to weave straw with silk to make cost-effective work bonnets. [1]

With inspiration long before her time, Ada Byron Lovelace predicted the development of computer software (including the term "software"), artificial intelligence, and computer music in 1843. [1]

Food processing and safety were dramatically and permanently changed when Amanda Theodosia Jones invented vacuum pack food canning. Typical of inventors of her time, she took no credit for this invention, claiming that it came from instructions from her deceased brother from beyond the grave. [1]

Prior to World War I, most women entered engineering through self-study and association with engineering husbands or fathers. Kate Gleason, for instance, began studying as an apprentice to her father when she was eleven years old. She was the first female engineering student at Cornell University, which was the first university in the eastern U.S. to admit women. She and her father developed an inexpensive machine for making beveled gears that were critical to improvements in many of the machines of the industrial revolution. She was also active in developing methods for cost-effective home construction. When she was asked to what she credited her success, she replied, "a bold front, a willingness to risk more than the crowd, determination, some common sense, and plenty of hard work." [1,2]

Another woman who made a difference in her time was Emily Warren Roebling, whose husband, Warren Roebling, and father-in-law, John Roebling, engineered the Brooklyn Bridge. Early in the construction an accident incapacitated John Roebling, and illness paralyzed Warren. Emily, who had studied higher mathematics, calculation of catenary curves, strengths of materials, bridge specifications, and the intricacies of cable construction, took over supervision of the remaining 11 years of the bridge's construction. [2]

The first and second World Wars required such an increase in the labor force that women were needed in all manufacturing capacities including engineering. As with their earlier counterparts, however, they rarely remained in engineering after marriage and certainly after having children.

One of the earliest examples of a successful mixing of family life and engineering is Lillian Gilbreth, who raised 12 children and ran *Gilbreth & Co.*, a consulting firm that specialized in management techniques, along with her husband, Frank. After the death of her husband, Lillian pioneered time and motion studies and the psychology of management that have contributed substantially to modern project management methods. [1,2]

Other inventions by women include the wringer washer (Ellen Eglui, 1888), windshield wipers for cars (Mary Anderson, 1903), refrigerated food transportation (Mary Engle Pennington), anti-jamming device for Nazi Radar (Hedy Lamarr, 1940s), first computer compiler and the term computer "bug" (Grace Murray Hopper, 1952), mechanical switching equipment for telephone (Erna Schneider Hoover, 1971), and numerous others. [1]

### **Conclusions**

The use of "Engineering State" to introduce students to the wide variety of applications and opportunities in engineering has been very successful in attracting students to engineering at Utah State University. In addition to the direct application to students, it is perceived as a positive outreach program in the community and enhances the University's public image. It requires a lot of effort by faculty and staff and some substantial donations from industry, but the positive effect is generally considered very much worth the effort.

The slide show "Making a World of Difference -- Women in Engineering" was premiered to a large audience at the Western Regional SWE Conference in Salt Lake City, February 1999. It is available on the web, for free download and use in Power Point format. Contact the author for the URL address. This slide show is recommended for use in recruitment and mentoring efforts for precollege and college students, for presentations to general audiences, and as a reference for media publications related to National Engineering Week, Women's History Month, and Society of Women Engineers (SWE) events.

### **References**

[1] Computer and Engineering Horizons, Fall 1998

[2] W.K. LeBold, D.J. LeBold, "Women Engineers: A Historical Perspective," ASEE Prism, March 1998, pp. 30-31