

# PROMOTING DIVERSITY IN KANSAS' FUTURE TECHNOLOGICAL WORKFORCE THROUGH OUTREACH PROGRAMS: THE BOEING EXPERIENCE

Marsha A. Meili<sup>1</sup>, Suzanne E. Franks<sup>2</sup>, Jennifer Whitlock<sup>3</sup>, and Susan Arnold<sup>4</sup>

**Abstract**---The Boeing Company values diversity as a means of staying competitive in a global marketplace. Outreach programs can help cultivate a diverse technological workforce in the state of Kansas. Corporate partnerships with university-based women/minorities in engineering programs enable both partners to leverage resources for the largest impact. For the past two years, Boeing has sent women engineers to the Kansas State University campus to participate in the Girls Researching Our World (GROW) summer workshop, [www.ksu.edu/grow](http://www.ksu.edu/grow). In addition, Boeing has participated for many years in National Engineer's Week programs such as "Engineer For A Day". In the past, this program has predominantly attracted boys. Recently, we worked with the Women in Engineering and Science Program (WESP) at K-State to draw a larger number of high school girls to this program. As a result, further collaborations with WESP were developed. Important factors for successful collaboration are identified, and evaluation data are reported.

**Index Terms**---diversity, industry partnership

## INTRODUCTION

Diversity is an important value for the Boeing Company. To remain competitive in today's global economic environment, Boeing must be capable of operating integrated product teams around the world. To do this, truly diverse teams are a necessity. In Kansas, Boeing needs to attract more females and minorities to engineering in order to develop the necessary technological talent for future projects as well as reflect the faces of Kansas' people.

Located in a city with a rich history of aviation, Boeing-Wichita has been part of the Kansas business landscape for more than 70 years, and is Kansas' largest manufacturing business. The site, with operations divided between commercial and military work, encompasses nearly 1,100 acres, employs over 12,000 people, and occupies about 12 million square feet of covered facilities.

The Boeing Company is committed to improving the quality of life in the communities in which its employees

and their families work. Boeing makes contributions in four major areas of need: Education; Health and Human Services; Arts and Culture; and Civic Initiatives. In particular, Boeing Wichita supports higher education in Kansas through a combination of scholarships at Kansas institutions and grants to programs that encourage minorities and women to pursue higher education. (For more information, see [www.boeing.com/wichita](http://www.boeing.com/wichita)).

In the past three years, Boeing has partnered with the Women in Engineering and Science Program (WESP) at Kansas State University (K-State) to reach girls across the state of Kansas. WESP is a cooperative effort between the Colleges of Engineering and Arts & Sciences at K-State, and is designed to cultivate the science and technology interests of women from the middle school through postgraduate levels. It serves seventeen science and engineering departments and has three main focus areas: outreach, recruitment, and retention. (For more information on WESP, see [www.ksu.edu/wesp](http://www.ksu.edu/wesp)).

Boeing-Wichita's strategic need for a diverse workforce in Kansas, and WESP's goal to encourage the participation of Kansas girls and women in the science and engineering workforce, are closely aligned. Thus, a partnership between these two entities makes sense for both. In this paper, we describe how the partnership came into existence and developed over time.

## INITIATION OF THE PARTNERSHIP

The Women in Engineering and Science Program at K-State was inaugurated in the fall of 1999. One of the authors of this paper, Suzanne Franks (SEF), was the founding director of WESP. In March 2000, SEF began communications via newsletter with K-State engineering and science alumni concerning the new program at K-State called WESP.

The partnership between Boeing-Wichita and WESP at K-State grew out of a casual e-mail contact between the authors of this paper in response to the initial newsletter. Marsha A. Meili (MAM), Boeing engineer and K-State Civil Engineering alumnus, contacted SEF to express personal interest in the new program. MAM offered to become both

<sup>1</sup> Marsha A. Meili, The Boeing Company, P.O. Box 7730, Wichita, KS 67277-7730 [marsha.a.meili@boeing.com](mailto:marsha.a.meili@boeing.com)

<sup>2</sup> Suzanne E. Franks, Pharmion Corporation, Corporate Woods Bldg. 14 Suite 240, 8717 W. 110<sup>th</sup> St., Overland Park, KS 66210 [sfranks@pharmion.com](mailto:sfranks@pharmion.com)

<sup>3</sup> Jennifer Whitlock, WESP, 125 Seaton Hall, Kansas State University, Manhattan, KS 66506-2905 [jennifer@ksu.edu](mailto:jennifer@ksu.edu)

<sup>4</sup> Susan Arnold, The GROW Project, 125 Seaton Hall, Kansas State University, Manhattan, KS 66506-2905 [suarnold@ksu.edu](mailto:suarnold@ksu.edu)

a participant in events and a financial supporter. Together they planned a trip for MAM to K-State, in the fall of 2000, to speak with Civil Engineering students and Society of Women Engineers (SWE) members. This visit provided a chance for both to learn more about each other, and to explore points of common interest between WESP and Boeing-Wichita. MAM's campus visit was the first event of the Boeing-Wichita/WESP partnership.

### **IMPORTANT FEATURES OF THE PARTNERSHIP**

MAM carried back to Boeing-Wichita leadership information about the new program at K-State. Mr. Robert J. Waner, Vice President-Engineering at the Wichita Division, responded positively to initial requests for Boeing-Wichita's participation in WESP-related events. Boeing-Wichita's partnership with WESP eventually grew to include three main components: sponsored travel for Boeing women engineers to the K-State campus; student-related events hosted at the Boeing-Wichita plant; and financial support of WESP-related events.

Boeing-Wichita already had an established policy of supporting education in the larger Kansas community, as noted in the introduction. Boeing-Wichita also had an established track record of support for the local Society of Women Engineers section. The additional factors that have made the partnership a real success, however, are people. MAM's personal advocacy for WESP programs and goals and willingness to carry the message to Boeing-Wichita leaders was crucial. And Mr. Waner's understanding of the importance of diversity to corporate health, and of the need to invest in long-term efforts for change, provided the top-level recognition and leadership necessary for a significant partnership to flourish.

From the point of view of the WESP director, Mr. Waner's willingness to sponsor travel for Boeing women engineers was nearly as important as the other two components of the partnership. This official recognition of the importance of outreach work on the part of Boeing engineers cannot be overestimated. Such sponsorship makes outreach work central to Boeing-Wichita's business, not merely a peripheral event that employees are encouraged to do in their "spare" time or by using vacation days.

In addition, MAM's growing responsibility and involvement in numerous Boeing-Wichita outreach programs has itself received official recognition in the past year. Mr. Waner designated MAM with responsibility for initiation of engineering outreach programs with other universities in Kansas as well as continued work to develop and enhance the relationship with WESP at K-State. Official recognition of this sort functions to establish and reinforce a corporate culture that values diversity as a business imperative rather than a "feel-good" extra. Thus, it functions in the short term to foster an inclusive climate that will help Boeing-Wichita attract a more diverse workforce in

the future, which is the long term goal of participation in outreach programs.

The benefits to K-State WESP were many and obvious. Clearly, financial support is always helpful. But so is having real-world engineers come to campus, make contact with students and enliven hands-on outreach programs. Events that show young girls what engineering is like are great; being able to take them to a real engineering site, show them what goes on, and let them follow engineers on the job, is even better. Finally, partnership with a Kansas industry leader such as Boeing-Wichita lends prestige and credibility to WESP outreach efforts, and adds weight to requests for ongoing or increased support from the K-State administration.

To date, Boeing and WESP have partnered in three primary outreach programs: the Girls Researching Our World (GROW) summer workshop held on the K-State campus; the annual Engineer for a Day program held at Boeing-Wichita; and the Summer Teen Women in Science and Technology (TWIST) workshop at both the K-State campus and the Boeing-Wichita plant. GROW is aimed at middle school girls, while the Engineer for a Day program and Summer TWIST serve high school students. These programs and partnership details are described below.

### **GIRLS RESEARCHING OUR WORLD (GROW)**

Faculty members and administrators at K-State created GROW with funding from the National Science Foundation in 1999 [1]. This outreach project for middle-school girls and for middle- and high-school teachers and counselors seeks to build a network of universities, schools, government agencies, non-profit organizations, and corporate entities who share an interest in supporting the interest of middle-school girls in science, mathematics, engineering and technology (SMET) disciplines. For more information on GROW, see references [1] and [2], and the project web site at [www.ksu.edu/grow](http://www.ksu.edu/grow). The GROW project coordinator, Susan Arnold (SA), has worked closely with MAM to develop and support Boeing's participation in GROW.

Following MAM's visit to K-State in the fall of 2000, SEF invited MAM and any other interested colleagues to participate in the 2001 GROW summer workshop. MAM and a woman senior manager traveled to campus in June 2001 to present workshops on the company, engineering, and Boeing's commitment to wastewater treatment and recycling. Workshop attendees learned that large companies not only produce their specialty products, such as airplanes but also have engineers who work to protect the environment.

This workshop reached 50 girls from 13 cities across the state of Kansas. Of the participants, the largest ethnic group represented was Anglo/White (73.5%), followed by African-American (20.4%), and other (6.1%). The "other" category included individuals whose parents came from different

ethnic heritages – Anglo/Hispanic or Native American/African American, for example.

According to the post workshop surveys, girls reported:

- increased confidence in math, science and/or engineering;
- increased awareness of careers in math, science and engineering; and
- increased awareness of the ways that scientists and engineers help protect the environment.

This is a small sample of the feedback from the girls regarding their experience at the workshop.

In June of 2002, Boeing again supported women in presenting programs at the GROW workshop. One presenter was a senior manager who again provided information on wastewater treatment and recycling. MAM talked about her education in civil engineering from K-State and how it prepared her for a career in structural engineering at Boeing. A hands-on bridge building session taught the girls about engineering, airplanes and teamwork.

Seventy-seven girls from 40 cities across Kansas and Missouri attended the three-day 2002 GROW workshop. Each participant took part in one of the six activity tracks. There were a total of twenty-six different science, engineering, and leadership activities offered during the workshop. Evening sessions included information on health, physical fitness, and a game in which they gained experience in making career-life decisions.

Pre and post survey results indicated that girls' confidence levels in all careers; both SMET and non-SMET, increased after completion of the workshop. One reason for this increase in confidence is a direct result of the environment of the GROW workshop. Girls are encouraged in the sessions to ask questions and participate in each step of the hands-on activities. One observer from a graduate course in gender equity commented on this factor; *"My favorite moment of the day came at the end of this session, when one girl said 'At my school, the boys always take over every project. But I think it's a lie that boys are better than girls'."*

GROW continues to be an important component of the powerful connection between Boeing and WESP. MAM will again present hands-on sessions to a new group of girls this June on the K-State campus.

## ENGINEER FOR A DAY

Boeing has regularly participated in National Engineers' Week activities over the years. In Wichita, this has included an annual "Engineer For A Day" program, organized by the Wichita Society of Professional Engineers. Many area engineering companies participate. All the high school students accepted into the program have lunch together, and the lunch features a keynote speech from an industry representative. For example, in 2002, Dr. W. Gene Corley of Construction Technology Laboratories, Inc. spoke about the collapse of the World Trade Center on September 11,

2001. During the rest of the day, local companies each play host to a certain number of the students. The students spend time on-site, job-shadowing engineers. They get to see their work areas and get a real taste of what an actual engineer does in a typical day. Engineer For A Day is the primary shadowing opportunity available to high school students at Boeing-Wichita and as such is a key event in which to include young girls.

In the past, this event has usually limited its draw of students to the Wichita area. Furthermore, it has predominantly attracted mostly boys. In February 2002, Boeing and WESP worked together to bring a more diverse group of high school juniors and seniors to the Boeing site. WESP offered transportation to girls in north central Kansas who might be interested in attending the program. Girls were recruited through direct contact with teachers who had been involved in other WESP events.

As a result of the partnership, approximately 40% of the Boeing-hosted students in 2002 were girls from northern Kansas, and approximately half of these girls were from underrepresented groups. The girls unanimously reported that the one-on-one time with their engineer mentors was the "best part" of the day. They also enjoyed the tour of manufacturing facilities for commercial airplanes, and several were particularly interested in the B-29 Bomber Restoration Project (see <http://b-29.boeing.com>). Over 1600 B-29s were built in Wichita in the 1940s. Boeing committed to be a partner in the restoration project of one B-29 known as "Doc" and provided hangar space for this work. Many retired and current employees volunteer their time to restore this aircraft to flying condition. The reaction of the girls to the luncheon keynote address was less positive. In part this may have been because it was held in a large ballroom, with a lot of distance between any one student and the speaker. The keynote address took place before the job shadowing, that is, before students had met any engineers in a more intimate one-on-one setting. It may have been harder for them to relate to the physically distant speaker prior to such contact.

It is the opinion of the authors that the restoration project held particular appeal for the students because it linked the less familiar (engineering) with the more familiar (history and preservation). Making linkages from engineering to other subjects already known to interest young girls can be important for stimulating further interest in engineering [3].

Both Boeing-Wichita and WESP were very pleased with the outcome of the event and the enthusiastic evaluation provided by student participants. It was decided to continue this aspect of the partnership. In February 2003, WESP again recruited girls in north central Kansas through its teacher network. This network is a formalized part of the GROW Project (see [1] and [2]). SA, GROW Project Coordinator, accompanied the young women recruited through WESP. Approximately 30% of the Boeing attendees in 2003 were young women, who again gave high

positive ratings to the plant tour and job-shadow portion of the program.

This program allows WESP to provide an attractive event to high school girls for the cost of transportation alone, and it facilitates Boeing-Wichita's outreach to a more diverse student population. It also offers an opportunity for girls who participated in GROW events during their middle school years to continue exploring their interest in science and engineering. Finally, the partnership helps make an exciting program available to girls outside Wichita and in more rural areas of the state. The authors hope that our efforts will eventually serve as a model of the possible for other engineering companies who participate in the Engineer for a Day program.

Based on our satisfaction with the program and the enthusiasm that the young girls expressed for the plant tour and job shadowing, it was decided to replicate this portion of the event in the Summer TWIST program. The partnership with Boeing thus helped shape the evolution a key WESP summer program in a very positive way, as described in the next section.

## **TEEN WOMEN IN SCIENCE & TECHNOLOGY (TWIST)**

TWIST began approximately 10 years ago as a one-day career exploration workshop held each January on the K-State Salina campus. Ninth-grade girls from the Salina, KS and Junction City, KS school districts are eligible to attend. TWIST offers approximately 250 young women a year the chance to meet in small groups with women scientists and engineers in various careers to learn more about their jobs and how to prepare for similar careers.

WESP is a member of the TWIST committee and the coordinating program for Summer TWIST. Initiated in 2002, Summer TWIST is a hands-on, three-day, residential science and engineering camp on the K-State campus. Summer TWIST is for girls who have just completed 8th and 9th grades, with preference to TWIST attendees. See [www.ksu.edu/twist](http://www.ksu.edu/twist) for more information. The Project Coordinator for Summer TWIST is Jennifer Whitlock (JW).

Building on the success of the partnership to date, Boeing and WESP collaborated on the design and implementation of the inaugural Summer TWIST workshop in June 2002. The GROW program was used as a template to expand the existing one day TWIST program, and several elements of the GROW Project are included in TWIST: faculty interaction with participants, hands on activities and industry tours. In the GROW workshop, participants sample a variety of engineering and science subject areas through a smorgasbord of activities. However, in Summer TWIST, all the workshop activities are integrated to a topic area, e.g. aerospace engineering or computer science.

On the first day of the workshop, participants get to know each other, explore ideas about engineers and engineering, and take part in a hands-on exercise designed to get them using tools and working in teams. On the second day, an industry tour is held. The third and last day of the workshop is comprised of intensive exploration of science and engineering concepts in an area related to the industry toured on the second day, with a culminating hands-on activity that is intended to bring all the experiences and concepts together. The on-campus activities on days 1 and 3 were lead by SEF, JW, and a team of three K-State engineering and physics faculty members. The faculty members, all men, had previously expressed an interest in helping with outreach activities that would encourage students to work with tools and develop hands-on skills.

In TWIST, the particular nature of the industry tours, and their integration with campus activities, was influenced by the experience with the Boeing Engineer For a Day program. The one-day visit was developed completely by Boeing members of the Wichita Society of Women Engineers, and was designed to provide mentoring, networking, tours and speakers for the young women who would participate. All the young women were matched with women engineers and technical designers at Boeing-Wichita. The day was structured to include the most popular features of the Engineer For a Day program, and with an eye to the kinds of activities that the young women would undertake on campus the following day. While the young women were spending time with their mentors, Boeing and WESP leaders met to discuss future partnering opportunities including additional visits to Boeing by students and engineer visits to schools throughout Kansas.

Fourteen young women attended the 2002 Summer TWIST workshop. The average age of workshop participants was 14.7, and 21.4% were from underrepresented minority groups. All but one of the participants had a computer at home; all participants had access to a computer at school or home. The top two types of computer use were to search the Internet for information and to write reports. Email and games tied for the third most popular use. All participants said they planned to attend college and 71% had a mother and/or father who had attended college.

The most frequently named favorite subjects in school were science (36%) and math (21%), suggesting that the workshop attracted participants who already had strong interests in these areas. However, only one of the participants (7%) selected engineering as a type of job that interested her. The most popular job choice was teacher (29%), with no other job choice selected by more than 2 or 3 of the participants. In contrast, on the post-workshop survey, 71% of participants (10 of 14) selected engineering as a job of interest. The second most popular choice was teaching (35%). No other job was selected by more than two participants.

Nearly half the participants (43%) identified the one-on-one time with Boeing women engineers and technical designers as their favorite part of the workshop. Reasons given included: learn better one-on-one; getting to meet people the mentor worked with and learn about their jobs; getting to see what a job was really like; finding out what mentors did in college; making connections between computer models and real life technology; getting to climb around on and sit in a plane. Three participants named a social activity, bowling, as their favorite activity. Reasons cited had mainly to do with the chance the activity offered to bond – and compete with – new friends. Two participants each chose building and test flying a model glider, and taking apart a mixer (team activity) as their favorite part of the workshop. Reasons cited included working with tools; figuring out how things worked; figuring out what went wrong and fixing it; and learning new things. When asked their least favorite activity, 71% of participants answered “nothing.” Of the three participants who named a least favorite activity, reasons cited had to do with physical comfort (did not like walking; headphones did not work during the Boeing plant tour) rather than the activity itself.

The post-workshop survey included an open-ended question, “any other information you’d like to share?” Participants overwhelmingly expressed satisfaction with the workshop, and several identified the one-on-one attention received at Boeing and in on-campus activities as a really important part of the workshop experience. One participant suggested “Switch things off every other year so people can go twice.”

As a result of the feedback from the pre- and post-workshop surveys, it was concluded that the form and content of the workshop had met the expectations of participants and greatly increased their interest in engineering careers. WESP wanted to offer the workshop to a greater number of participants in subsequent years, but clearly the one-on-one attention and small group atmosphere were important to the success of the experience for participants. In addition, the industry host, Boeing, could handle only a limited number of students at a time and still be able to provide one-on-one time with women engineers. Finally, there was the participant request for additional topic areas, so that individuals could attend the workshop more than once. The K-State faculty participants also felt that it was important to keep a low student-to-faculty ratio in the workshop. The conclusion was that the workshop must be expanded by developing additional tracks that followed the format of the initial workshop: introductory activities and a hands-on team project on day one; industry tour on day two; and special topic background with culminating project on day three.

It was noted that while all our participants in the initial workshop had access to computers, none were engaged in programming or other aspects of hardware or software exploration. Their computer usage was confined to word processing, web surfing, and email or games. This is not

uncommon for young women in this age group, as noted in the American Association of University Women *Tech Savvy* report [4]. In addition, the department head of computing and information sciences (CIS) at K-State had recently approached SEF to ask about ways that his department could more effectively reach out to and recruit young women into the computer science field. Thus, WESP decided to pursue development of a computer science track focusing on robotics for the 2003 workshop. With the approval and encouragement of the CIS department head, 2 faculty members and a graduate student have begun work with JW to develop a computer science track that will include an industry tour at Garmin in Kansas City and Hallmark in Topeka. The partnership with Boeing-Wichita will continue with a one-day visit planned for July 2003.

### **FUTURE PARTNERSHIPS WITH WESP AND OTHER KANSAS ORGANIZATIONS**

While Boeing continues to partner with WESP, it also looks to enhance its partnerships with other universities across the state of Kansas. Along with K-State, the other primary engineering universities in Kansas are the University of Kansas and Wichita State University. In September 2002, Boeing sponsored two women engineers to meet and dine with students at the University of Kansas “Evening With Industry”. The Diversity Programs in the School of Engineering sponsored this event. The University of Kansas hosts a week-long program each summer called Project Discovery. Boeing has begun dialog with the organizers in order to develop a personal presence in the program as well as supporting the program financially.

Additional ideas are being developed to work more closely with Wichita State University. Other plans include meeting on a regular basis with the SWE student sections of the three engineering programs in Kansas universities.

### **CONCLUSIONS – INDUSTRY VIEWPOINT**

The future technological workforce of Kansas depends on encouraging diverse students to consider engineering as a career field. Industry and the university system will need to work together to realize this goal. While financial support is very important, we believe that personal involvement such as that demonstrated by Boeing people in university-based outreach programs is key to successful partnering.

More diverse teams will bring more diverse input to problem solving and product development. Without diversity, opportunities are lost. Industry must develop and support a passion for supporting programs such as GROW and TWIST. They are making a significant difference!

For Boeing, this partnership with WESP provides an avenue to make the Company known across the state of Kansas. Even though it is one of the state’s largest employers, Boeing is not as well-known in rural western

Kansas or in the northeast near the Kansas City metropolitan area. This partnership provides an avenue for young women to visit a manufacturing workplace, talk with women engineers, and meet other young women who may be interested in a technical field. Engineers, both men and women, learn to relate with young students who may share their career interests. The engineers have an opportunity to enhance their communication and mentoring skills as well as appreciate the value of diversity in the upcoming workforce.

For the women engineers at Boeing, it is especially gratifying to see girls and young women able to explore many career options. In all these areas, Boeing benefits by learning more about the university programs and how it might influence the education process. WESP and all its students benefit by learning about Boeing, engineering, and careers in the aircraft industry. All of the people involved expand their sphere of learning and understand more about diversity.

### CONCLUSIONS – UNIVERSITY VIEWPOINT

Women in engineering/women in science programs all are focused on encouraging and supporting girls and women to explore careers in science and engineering. Industry partnerships are a critical component of the work these programs do. Indeed, industry partners often provide a significant percentage of funding for outreach activities and other program offerings. But, as we have shown through the Boeing/WESP experience, these partnerships have the potential to offer much more to both parties.

For WESP, the partnership with Boeing actually helped in the design of a successful outreach program, yielding a template for expansion that can help us build additional close partnerships with other corporate entities. We can now offer young high school women in Kansas a summer program with real-world experience, and the chance to meet many more women engineers than would be possible even if every woman faculty member on the K-State campus participated. We believe the industry partnership of the summer workshop makes participation an attractive option for departments and their faculty, who can initiate new, or further solidify existing partnerships at the department and faculty level. Participating faculty – at this point, all male – get the chance to work one-one with young women, to see their excitement about and interest in technology, and to experience them as capable of handling tools and solving problems. We hope that in the long-term, this experience will be translated into the classroom, as participating faculty become more active and more effective advocates and mentors for the young women undergraduates they teach.

The initial Summer TWIST workshop attracted young women from small towns in central and western Kansas. Career exploration opportunities for young women in these areas are limited. Many of the young women who participate in our outreach programs have never been in a city as large as Manhattan, Kansas (pop. 44,800) and have

not had the opportunity to be around or learn about industries that employ scientists or engineers. As we expand our program offerings, we will look for ways to continue drawing young women from rural areas to participate. One possibility, proven quite effective in the GROW Project, is to provide transportation to and from campus from a central pickup point in outlying areas.

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