

Concord Evaluation Group

Invent It. Build It. 2018: Evaluation Report

January 2019

Citation

Paulsen, C.A. and Carroll, S. (2019). *Invent It. Build It. 2018: Evaluation Report*. Concord, MA: Concord Evaluation Group.

Support for this study

This research was performed on behalf of Society of Women Engineers, 130 E Randolph Street, Suite 3500, Chicago, IL 60601, with support from the ExxonMobil Foundation.

Contact

For questions or more information about the *evaluation study*, please contact:

Christine Andrews Paulsen, Ph.D.
President
Concord Evaluation Group
PO Box 1205
Concord, MA 01742
(978) 369-3519
cpaulsen@concordevaluation.com

For questions about the *Invent It. Build It.* event, please contact:

Randy Freedman, M. Ed
Director of Student Programs
Society of Women Engineers
130 E Randolph Street, Suite 3500
Chicago, IL 60601
(312) 596-5232
randy.freedman@sweoffice.org

Table of Contents

Executive Summary	i
Background	i
Findings: Middle School Girls	ii
Findings: High School Girls	iv
Findings: Parents and Educators.....	v
Findings: EXPO Exhibitors	vii
Background	1
Study Design	3
Participants	4
Middle School Girls	4
High School Girls.....	5
Parents and Educators.....	6
EXPO Exhibitors.....	7
Findings.....	8
Middle School Girls	8
Attitudes and Beliefs about Engineering	8
Knowledge of Engineering	9
Confidence in Engineering-related Skills.....	10
Feedback on the Event.....	11
Suggestions for Improvement.....	14
High School Girls.....	16
Attitudes and Beliefs about Engineering	16
Feedback on the Event.....	17
Suggestions for Improvement.....	18
Parents and Educators.....	19
Feedback on the Event.....	19
Suggestions for Improvement.....	24
EXPO Exhibitors.....	26
Feedback on the Event.....	26
Suggestions for Improvement.....	28
Appendix A: Scheduled Events and Activities	A-1

Appendix B: Activity Sheets	B-1
Appendix C: Survey Instruments.....	C-1

Executive Summary

Background

The Society of Women Engineers (SWE) with funding from the ExxonMobil Foundation and in partnership with Girls Scouts of the USA, WGBH's Design Squad and Techbridge held the ninth annual *Invent It. Build It. (IIBI)*. The event took place at the SWE annual conference in Minneapolis, MN. Participants included 303 middle school girls, 128 high school girls, plus 214 of their parents/guardians and educators.

In addition, 282 SWE members volunteered at the event to facilitate the activities, act as role models, and work closely with the middle school and high school girls throughout the day. 60 exhibitors provided information about camps, competitions, and resources as part of the *Invent It. Build It. EXPO*.

Concord Evaluation Group was hired to conduct an independent evaluation of the event. This report summarizes the evaluation findings.

The evaluation found strong evidence, as it has year after year, that SWE continues to achieve its goals for *Invent It. Build It*. Once again, the event...

- Changed girls' attitudes about engineering careers by exposing them to different ways of thinking about engineering.
- Engaged girls in two different hands-on engineering activities to build their self-confidence and critical thinking skills as they relate to engineering.
- Enabled girls, parents, and educators to meet and network with engineering role models.
- Helped girls draw connections between their career passions and engineering by sharing personal stories and celebrating the accomplishments of women engineers.
- Developed girls' understanding of what engineers do by interacting with the SWE volunteers.
- Enabled girls to identify what the next steps of becoming an engineer are by interacting with the SWE volunteers and local STEM organizations at the EXPO.

Findings: Middle School Girls

After the event, nearly every girl agreed that engineering was creative (99%) and hands-on (96%), was a good career choice for women (96%), allowed one to help one's community (93%), and was fun to do (90%). These findings are consistent with last year's findings.

We asked girls to report how their attitudes and interest in engineering changed, if at all, as a result of participating in the *Invent It. Build It.* event. Forty-one percent of the girls told us they were interested in becoming an engineer before the event, and this increased to 63% after the event (Figure 2). In fact, similar to the past three years, the difference between girls' reported interest in engineering before and after the event was statistically significant. Further, 70% of girls saw a connection between their interests/passions and engineering.

Since engineering activities typically play a significant role in Girl Scouts' programming, we asked girls about their level of interest in joining Girl Scouts after attending the event. Twenty-eight percent of the sample of girls reported that they already were Girl Scouts. Of the remaining girls, slightly over half (56%) reported that they definitely or might be more interested in being involved with the Girl Scouts after attending the *Invent It. Build It.* event.

We asked girls if they knew what an engineer did before and after the event. Seventy-six percent of girls reported that they knew what an engineer did before the event. This number increased to 96% after the event (Figure 3). Again, similar to the past three years, the difference between girls' reported engineering knowledge before and after the event was statistically significant.

Additionally, as in prior years, a majority of the girls (83%) reported that they felt empowered to find out more about engineering and technology if they wish (after participating in the event).

When asked whether their friends would support their interest in engineering or technology, 78% of the girls reported that they would. Similarly, 95% of the girls reported that their family supports their interest in engineering or technology.

We found that most girls reported improvements in: their confidence in building (85%) and designing (84%) things, their ability to think of many different possible ways to solve a problem (82%), and their confidence in problem-solving (78%).

Nearly all girls rated the event highly, grading it 'A' (74%) or 'B' (23%). We asked girls what they liked most about the event. Several responded that they liked the whole day and described it as fun. More than half (57%) reported that they enjoyed the activities the most. The EXPO was also a big hit. Twenty-eight

percent of girls reported that this was their favorite, or one of their favorite parts of the day. The next most frequently reported “favorite aspect” of the event was using teamwork and working in groups (reported by 14%). Other common responses included that they enjoyed the food (reported by 12% of girls), meeting and working with new people (reported by 9% of girls) and learning about engineers and what they do (reported by 7% of the girls).

To gather additional feedback on the activities, we asked the girls to rate the Wind Power Station activity. Nearly all of the girls rated the activity highly, giving it a grade of ‘A’ (71%) or ‘B’ (25%).

Most of the girls reported that they would recommend that other girls participate in events like IIBI (87%) and the remaining 13% said “maybe” they would.

We asked questions about the girls’ experiences with the role models with whom they worked during the event. Nearly all girls reported that the role models were provided support and encouragement (98%), guided them during the activities (96%), were approachable (96%), listened actively to the girls’ ideas (95%), and inspired them to consider a career in engineering or technology (85%).

Like last year, the role models handed out trading cards featuring female engineers during the EXPO. We asked the girls how many different trading cards they collected. Twenty-seven percent of the girls reported collecting 1 to 5 different trading cards, while 11% of the girls collected 6 to 10 cards and 5% of the girls collected more than 10 different trading cards. Fifty-seven percent of the girls reported that they did not collect any trading cards.

We asked the girls about their favorite demonstration during the EXPO. Eleven percent of the girls reported that they liked all of the demonstrations. Of the remaining girls who had a favorite, the most frequently reported favorite demonstrations were making the bouncy ball (22%), robot (6%), slime (5%), U.S. Army booth (5%), balloon (4%), and virtual reality (4%).

We asked girls to tell us what they would change about the event, if they could. A quarter (25%) of the girls reported that they wouldn’t change anything about the event. The most frequently reported change that girls said they would make was to add more types of activities (14%). Another popular response girls gave was that they would add more time for both the activities (12%) and the EXPO (11%).

Findings: High School Girls

After the event, a majority of high school girls (93%) reported that they know their families support their interest in engineering or technology and 88% of these same girls reported their friends would support their interest in engineering or technology.

Ninety percent of high school girls reported that they felt empowered to find out more about engineering and technology if they wished. In addition, 89% of high school girls reported that the role models inspired them to consider a career in engineering or technology and 80% reported that they saw a connection between their interests and passions and a career in engineering or technology.

Nearly all high school girls rated the event highly, grading it 'A' (66%) or 'B' (31%). We asked girls what they liked most about the event. Over half (61%) of the girls who responded reported that they liked the activities. Slightly more than one third (36%) of the girls enjoyed the EXPO, while others valued the chance to meet other girls like them with similar interests (8%). Others reported that they enjoyed meeting and working with the role models (7%). We asked girls to tell us what they would change about the event, if they could. Many reported (17%) that they would like clearer instructions while others (16%) requested more time to complete the hands-on activities.

Girls rated the EXPO highly, grading it 'A' (76%) or 'B' (20%). The most common comments about the EXPO were that the girls had fun, but some of the girls commented that it was long and could be made shorter. In addition, girls rated the Hydraulic Activity (Ariel Biggs) very highly, grading it 'A' (68%) or 'B' (25%). The most common comments about the activity was that it was challenging, but also fun and interesting. In addition, a few girls commented that they would have liked more time.

Almost all of the girls reported that they would recommend that other students participate in events like IIBI (90% said "yes" with an additional 10% saying "maybe").

Twenty-four percent of high school girls reported collecting 1 to 5 different trading cards, while 9% of the girls collected 6 to 10 cards and 7% of the girls collected more than 10 different trading cards. Fifty-nine percent of the girls reported that they did not collect any trading cards.

We asked the girls about their favorite demonstration during the EXPO. Fourteen percent of the girls reported that demonstrations at various college booths were their favorite, followed by the U.S. Army demonstration (13%), the bouncy ball demonstration (8%) and the Google demonstration (6%).

Findings: Parents and Educators

The feedback from adults (engineers and non-engineers alike) who attended the event was very positive. All of the adults replied “yes” (96%) or “maybe” (4%) when asked if they would recommend the *Invent It. Build It.* event to others. As we observed in the past three years, adults rated the overall event highly, with all but one adult grading it ‘A’ (78%) or ‘B’ (20%).

We also asked adults to rate each segment of the event with a grade. Most adults gave ‘A’ or ‘B’ ratings to each segment including non-engineers, just like the past three years.

Nearly all the participants, regardless of whether they were engineers, agreed or strongly agreed with the following statements:

- This event helped me learn where to find resources for girls/my daughter (93% of all adults, including non-engineers, consistent with the previous two years).
- I feel empowered to help more girls/my daughter become an engineer someday if they want to (95% of all adults and 96% of non-engineers, consistent with 2017 and a slight increase over 2016).
- This event helped me feel well-equipped to talk with girls/my daughter about a career in engineering (95% of all adults, including non-engineers, a slight decrease from 2017 and consistent with 2016).
- This event helped me understand why engineering is a good career choice (96% of all adults, including non-engineers, consistent with the previous year and an increase over 2016).
- This event helped me understand what engineers do (97% of all adults and 98% of non-engineers, representing an increase over the previous two years).
- I had a chance to meet professional engineers today (95% of all adults, including non-engineers, consistent with the previous two years).
- I had fun today (97% of all adults and 98% of non-engineers, consistent with the previous year and representing an increase over 2016).

- My goals were met today (91% of all adults, including non-engineers, consistent with the previous year and representing a significant increase over 2016).
- This event helped me to understand what it takes to become an engineer (90% of all adults and 91% of non-engineers, representing a significant increase over the previous two years).
- All my questions were answered today (86% of all adults and 84% of non-engineers, representing a slight increase over the previous year and a more significant increase over 2016).

As in previous years, parents were less likely to agree that the event helped them understand why there were so few women in engineering:

- This event helped me understand why there are so few women in engineering (71% of all adults and 74% of non-engineers, representing a slight decrease from the previous two years).

We asked adults to report what they learned at the event that they did not know beforehand. The most popular response was that they learned about the wide range of engineering disciplines and careers that existed within the field of engineering (27%). Another 23% of adults reported that they learned about the various resources available to them. In addition, fifteen percent of adults reported that they learned about pursuing a college degree in engineering.

We asked the adults what features they liked most about the event. The most popular response was that adults enjoyed the EXPO the best (38%). Similarly, 19% mentioned they enjoyed learning from the panel, 15% mentioned that they liked having access to the engineers, and 15% mentioned the hands-on activities as what they liked the best.

We asked adults to make suggestions for enhancing the event. Eleven percent reported that they would not change anything about the event, which is down from 31% last year. Of the adults who did make suggestions, 35% reported that they would like more information across a variety of areas. In addition, some (8%) reported they thought the event volunteers could have been more prepared to execute the logistics of the event. Another 8% suggested logistical improvements to the lunch portion of the event.

Eighteen percent of adults reported collecting 1 to 5 different trading cards, while 6% of the adults collected 6 to 10 cards and 3% of the adults collected more than 10 different trading cards. Seventy-four percent of adults reported that they did not collect any trading cards.

We asked the adults about their favorite demonstration during the EXPO. The most popular response was the bouncy ball (9%), followed by the various college demonstrations (8%), Medtronic demonstration (6%), robotics demonstration (6%), airplane demonstration (5%), and the CIA demonstration (5%).

Findings: EXPO Exhibitors

Again, this year, EXPO Exhibitors were surveyed and rated the EXPO positively, grading it 'A' (77%) or 'B' (23%), representing a significant increase from the ratings last year of 'A' (34%) or 'B' (48%) and the ratings in 2016 of 'A' (37%) and 'B' (59%).

Most of the exhibitors (85%) reported that the set-up and tear-down of the booth went smoothly. Almost all of the exhibitors (96%) enjoyed interacting with the adults and children who visited their booths, while 96% of exhibitors enjoyed the fact that this was an event for girls. Most of the exhibitors (87%) reported that they would be interested in exhibiting at other SWE conferences, whether local or national. Seventy-one percent of exhibitors agreed or strongly agreed that registration went smoothly and almost all (94%) perceived that their booth received enough interest and foot traffic.

Only sixty-seven percent of exhibitors agreed that the on-site check-in process was helpful. Slightly less than two thirds (60%) of the exhibitors agreed or strongly agreed that SWE's IIBI EXPO compares favorably with others where they have exhibited, and less than half (42%) agreed the fee for exhibitor registration was reasonable.

We asked exhibitors what they liked most about the EXPO. Over a third (35%) liked interacting with the girls. In addition, another 35% of the exhibitors noted the turnout at the event and liked the level of enthusiasm and engagement of the girls. Other comments from exhibitors about what they liked most included the variety of hands-on activities (19%), the variety of exhibitor booths (13%), and the facilities (10%).

Finally, we asked exhibitors what they would change. Slightly more than a quarter (26%) of the exhibitors would like to make improvements to the logistics related to their booth and another 15% would like more space at their booth. Eleven percent of exhibitors suggested adding more time for the event.

Background

On Saturday, October 20, 2018 the Society of Women Engineers (SWE), Girl Scouts of the USA, WGBH's Design Squad Global, the ExxonMobil Foundation, and Techbridge held the ninth annual day-long collaborative event *Invent It. Build It.* for middle school girls at the SWE annual conference in Minneapolis, MN. SWE invited middle school girls, high school girls, their parents/guardians, and educators (both formal and informal educators) to participate.

A total of 303 middle school girls attended the event, along with 214 parents and/or educators, and 128 high school students. Deysi Melgar, a cast member from Season 2 of WGBH's *Design Squad*, served as the special host of the event. In addition, 282 SWE members volunteered at the event to facilitate the activities, act as role models, and work closely with the middle school girls throughout the day. Fifty-two exhibitors provided information about camps, competitions and resources as part of the *Invent It. Build It.* EXPO. The schedule of events and activities for the girls as well as their parents and educators are included in Appendix A.

The purpose of the event was to:

- Change girls' attitudes about engineering careers by exposing them to different ways of thinking about engineering.
- Engage girls in two different hands-on engineering activities to build their self-confidence and critical thinking skills as they relate to engineering.
- Enable girls, parents, and educators to meet and network with engineering role models.
- Help girls draw connections between their career passions and engineering by sharing personal stories and celebrating the accomplishments of women engineers.
- Develop girls' understanding of what engineers do by interacting with the SWE volunteers.
- Enable girls to identify what the next steps of becoming an engineer are by interacting with the SWE volunteers and local STEM organizations at the EXPO.

The middle and high school girls spent part of their day engaging in one hands-on engineering activity with engineer mentors. The activity for each was:

- **Wind Power Station** – Middle school girls designed a machine that can use wind to accomplish a task, such as lifting a weight or turning a pencil to make a drawing.
- **Hydraulic Activity** – High school students designed a new hydraulic brake caliper, fluid, and pad combination for the ABC Racing Inc. brake rotor compound reputed to be stronger, lighter, and more heat resistant than any other on the performance market.

The detailed activity sheets are included in Appendix B.

Parents and educators were invited to spend the day engaged in a separate set of activities—networking with engineers and each other, participating in a panel discussion with SWE members and outreach experts, and doing a hands-on activity of their own (Design Squad’s Safe Landing– design and build a system to deliver goods safely in an air drop).

Study Design

Concord Evaluation Group (CEG) conducted an evaluation study to learn about the event's impact on girls as well as to discover ways to enhance future *Invent It. Build It.* events. CEG collaborated with SWE to refine four surveys to collect feedback on the event from its participants. These data collection instruments are included in Appendix C. All surveys were administered at the end of the event day.

Participants

Middle School Girls

As in previous years, the girls who attended the event were from diverse backgrounds. Just under half of the girls identified themselves as White (47%), 20% were Black or African-American, 13% of participants were Hispanic, 10% were Asian, and 12% preferred not to answer. An additional 4% were Native Hawaiian, Native Alaskan, Native American, or Pacific Islander while another 4% selected “other,” some indicating they were of multiple races or ethnicities. Compared to last year, fewer girls this year identified themselves as Hispanic, Latina, or Spanish. A greater percentage this year identified themselves as White or as Black or African-American, or Asian American. The grades of the girls ranged from fourth to eighth with nearly half (45%) being sixth graders.

**Table 1:
Middle School Girls’ Background Characteristics**

	Number and Percent
<i>Race/ethnicity</i>	N = 254
White or European American	119 (46.9%)
Black or African-American	50 (19.7%)
Hispanic, Latina, or Spanish	34 (13.4%)
Prefer Not to Answer	31 (12.2%)
Asian American	26 (10.2%)
Native American or Alaskan Native	9 (3.5%)
Native Hawaiian or Pacific Islander	1 (0.4%)
Other	9 (3.5%)
<i>Grade</i>	N = 254
Fourth	2 (0.8%)
Fifth	10 (3.9%)
Sixth	115 (45.3%)
Seventh	60 (23.6%)
Eighth	67 (26.4%)

Note: Some girls selected more than one ethnicity, so percentages do not add up to 100%.

Each girl was asked if she was a member of SWENext. Of the girls who responded (n = 254) 71% were not members and 2% were members of SWENext. The remaining 27% were unsure whether they were members of SWENext.

In addition, each girl was asked if she was a member of a SWENext Club. Of the girls who responded (n = 254) 73% reported that they were not members, while 27% reported that they did not know if they were members of a SWENext Club.

High School Girls

For the fourth year, SWE collected data from a sample of high school girls. Fifty-seven percent of the high school girls identified themselves as White, 27% were Asian, 16% were Black or African-American, 6% were Hispanic, Latina, or Spanish, and 1% were Native American or Alaskan Native. The high school girls were in grades nine through twelve. Their background characteristics are summarized below.

**Table 2:
High School Girls' Background Characteristics**

	Number and Percent
<i>Race/ethnicity</i>	N = 108
White or European American	62 (57.4%)
Asian American	29 (26.9%)
Black or African-American	17 (15.7%)
Hispanic, Latina, or Spanish	6 (5.6%)
Native American or Alaskan Native	1 (0.9%)
Other	1 (0.9%)
<i>Grade</i>	N = 109
Ninth	24 (22.0%)
Tenth	37 (33.9%)
Eleventh	30 (27.5%)
Twelfth	18 (16.5%)

Note: Some girls selected more than one ethnicity, so percentages do not add up to 100%.

We asked the high school girls if they were members of SWENext. Of the 108 girls who provided an answer, 19% indicated they were, while 61% indicated they were not. An additional 19% reported that they were unsure if they were members of SWENext.

We also asked the girls if they were members of a SWENext club. Of the 108 girls who provided an answer, 7% indicated they were, while 71% indicated they were not. An additional 21% of the girls reported that they were unsure whether they were members of a SWENext Club.

Parents and Educators

Parents, educators, and troop leaders attended the conference and 112 adults completed surveys at the end of the day. Table 3 summarizes their background characteristics. Similar to the girls, adults more frequently self-identified as White (63%) than Black or African-American (14%), or Asian American (10%) or Hispanic, Latino/a, or Spanish (6%) or Native American or Alaskan Native (1%), or other races/ethnicities.

**Table 3:
Adults' Background Characteristics**

	Number and Percent
<i>Race/ethnicity</i>	N = 109
White or European American	69 (63.3%)
Black or African-American	15 (13.8%)
Asian American	11 (10.1%)
Hispanic, Latino/a, or Spanish	7 (6.4%)
Prefer Not to Answer	5 (4.6%)
Other	1 (0.9%)
Native American or Alaskan Native	1 (0.9%)
<i>Relationship to girls attending the event</i>	N = 112
Mother	78 (69.6%)
Teacher	25 (22.3%)
Troop Leader	21 (18.8%)
Father	17 (15.2%)
Other (grandparent, coach, mentor, etc.)	10 (8.9%)
Guardian	8 (7.1%)
<i>Professional engineer</i>	N = 112

	Number and Percent
No (includes engineering students)	96 (85.7%)
Yes	16 (14.3%)
<i>Affiliation with SWE</i>	N= 112
Not Affiliated	80 (71.4%)
Parent/Guardian of SWENext Member	23 (20.5%)
K-12 Educator Member	7 (6.3%)
SWE Collegiate or Professional Member	4 (3.6%)
SWENext Club Advisor	1 (0.9%)
<i>Level of Students They Work with in Education Field</i>	N= 110
Not in education field	56 (50.9%)
Middle School	19 (17.3%)
High School	18 (16.4%)
Elementary	14 (12.7%)
College	5 (4.5%)
Other	4 (3.6%)

Note: The adults selected more than one ethnicity, relationship to girls and level of students they work with; so, percentages for those background characteristics do not add up to 100%.

EXPO Exhibitors

SWE surveyed EXPO exhibitors. In total, 52 exhibitors completed surveys. Demographic information was not collected.

Findings

Middle School Girls

Attitudes and Beliefs about Engineering

Since one objective for the event is to encourage girls to think about engineering as a future career choice, we asked middle school girls to indicate the extent to which they believed that engineering embodied desirable characteristics of a future job. Consistent with previous years, nearly every girl agreed that engineering was creative (99%) and hands-on (96%), was a good career choice for women (96%), and allowed one to help one's community (93%). Most girls also agreed that engineering was fun to do (90%) (Figure 1).

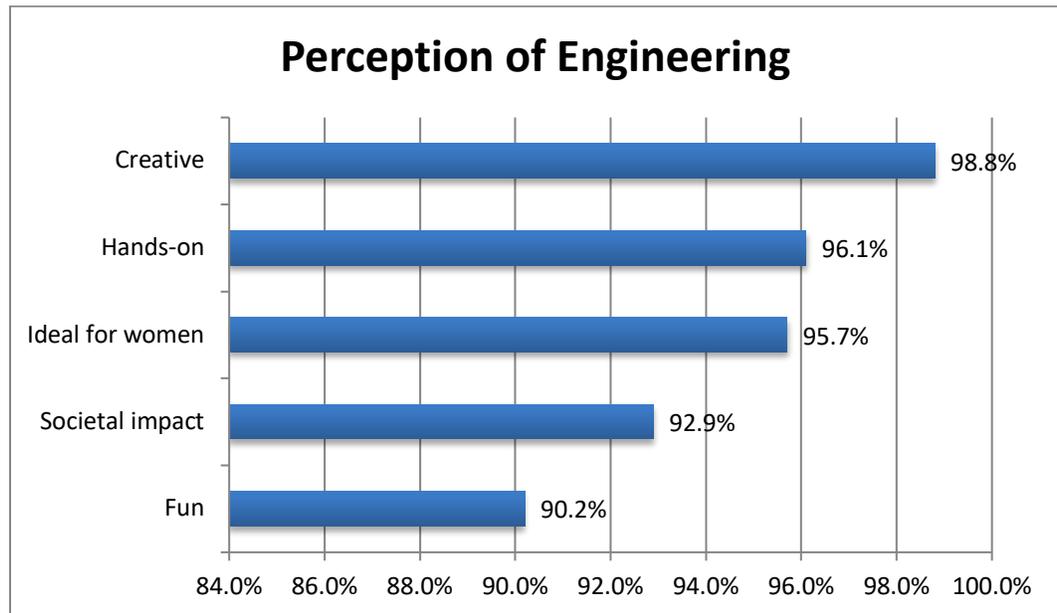
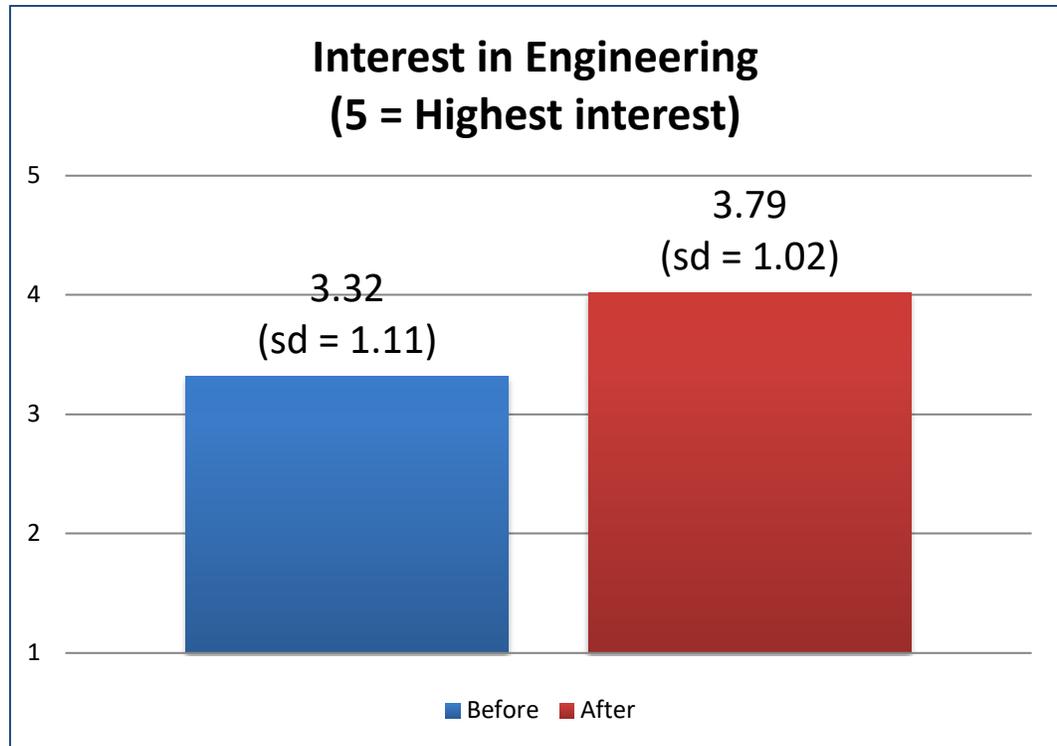


Figure 1. Perceptions of engineering.

We asked girls to report how their attitudes and interest in engineering changed, if at all, as a result of participating in the *Invent It. Build It.* event. Forty-one percent of girls told us they were interested in becoming an engineer before the event, and this increased to 63% after the event (Figure 2). In fact, similar to the past four years, the difference between girls' reported interest in engineering before and after the event was statistically significant. Further, 70% of girls saw a connection between their interests/passions and engineering.



Note: Paired t-test (df = 262) = 8.919, $p < 0.000$, Cohen's d effect size = 0.30.

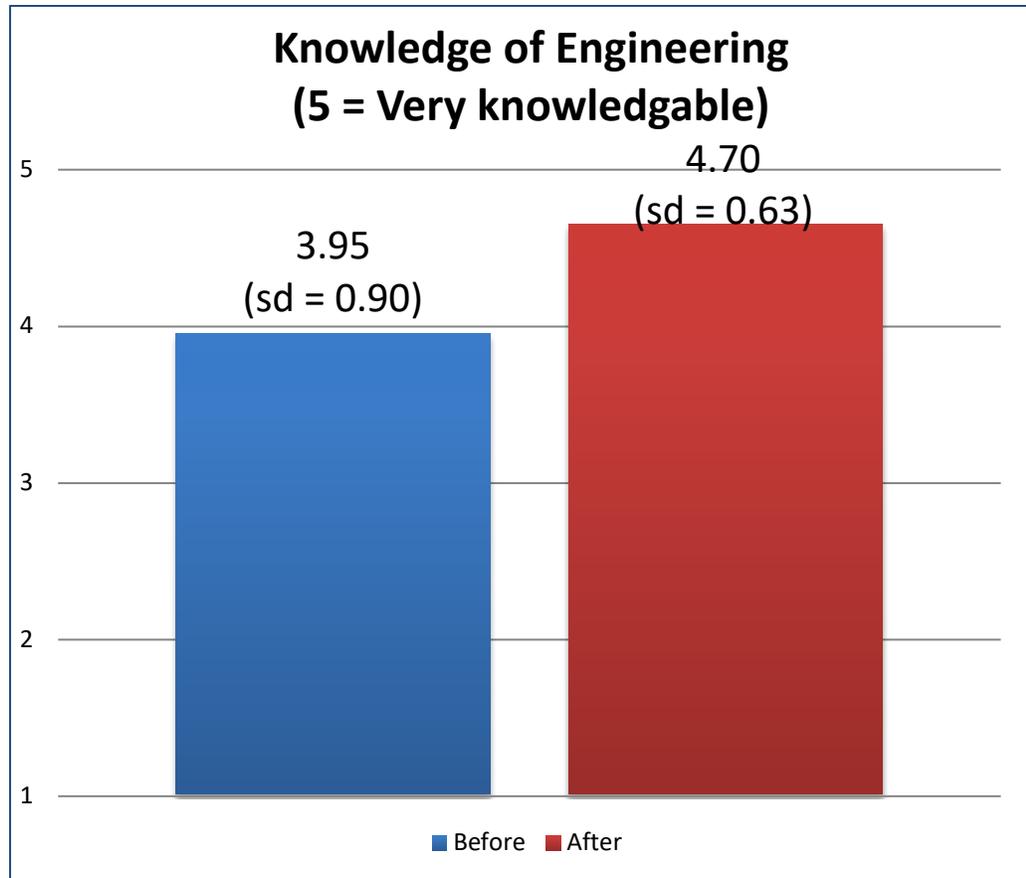
Figure 2. Average level of self-reported interest in becoming an engineer before and after *Invent It. Build It.*

Like the last three years, most girls also reported that they knew their families would support their interest in engineering or technology (95%). This year, slightly more than three-quarters of the girls reported that they knew their friends would support their interest in engineering or technology (78%).

Since engineering activities typically play a significant role in Girl Scouts' programming, we asked girls about their level of interest in joining Girl Scouts after attending the event. Slightly more than one-quarter of girls reported that they already were in Girl Scouts (28%). Of the remaining girls, slightly over half (56%) reported that they definitely or might be more interested in being involved with the Girl Scouts after attending the *Invent It. Build It.* event.

Knowledge of Engineering

We asked girls if they knew what an engineer did before and after the event. Seventy-six percent of girls reported that they knew what an engineer did before the event. This number increased to 96% after the event. Again, similar to the past four years, the difference between girls' reported engineering knowledge before and after the event was statistically significant.



Note: Paired t-test (df = 262) = 14.584, $p < 0.000$, Cohen's d effect size = 0.81.

Figure 3. Average level of self-reported knowledge about engineering before and after *Invent It. Build It.*

Additionally, as in prior years, most of the girls (83%) reported that they felt empowered to find out more about engineering and technology if they wished to do so (after participating in the event).

Confidence in Engineering-related Skills

Another one of the event goals is to increase girls' confidence in engineering-related skills. We found that most girls reported improvements in: their confidence in building (85%) and designing (84%) things, their ability to think of many different possible ways to solve a problem (82%), and their confidence in problem-solving (78%).

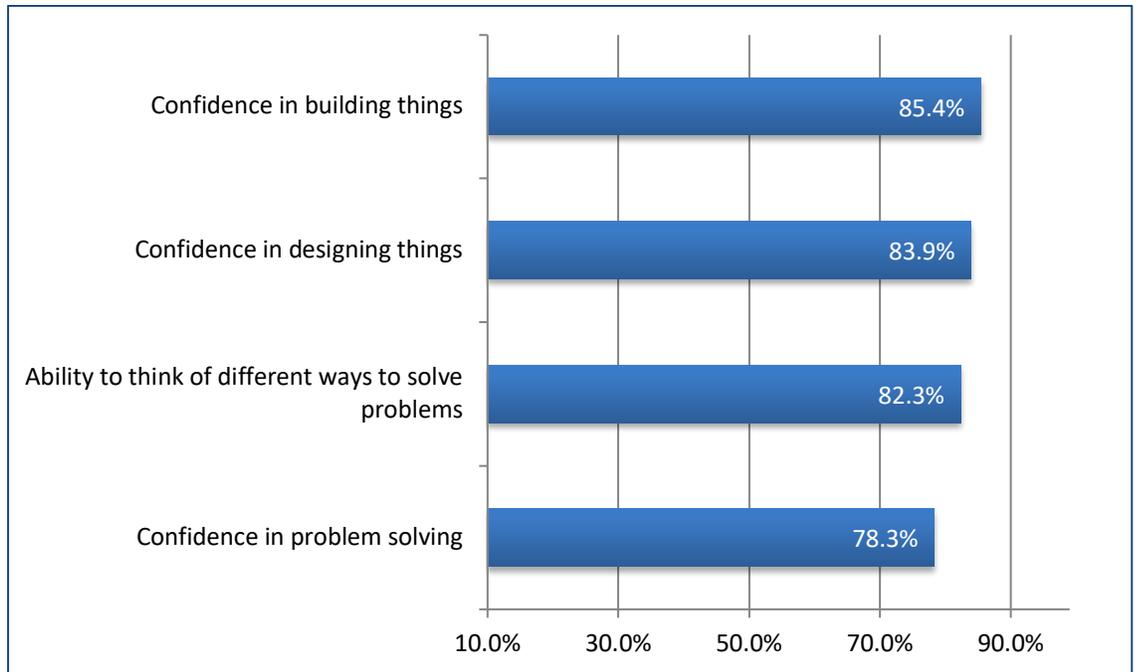


Figure 4. Proportion of girls' who reported improvements in engineering-related confidence and abilities after participating in the *Invent It. Build It.* event.

Feedback on the Event

Nearly all girls rated the event highly, giving it a grade of 'A' (74%) or 'B' (23%). We asked girls what they liked most about the event. Several responded that they liked the whole day and described it as fun. Of the 251 girls who responded to this question, more than half of the girls (57%) reported that they enjoyed the hands-on activities the most. For example, some girls reported:

- *Designing the wind turbines, making it, testing the wind turbine (the most important part).*
- *I liked brainstorming and building the wind turbines.*
- *It was very hands on and your project, not anyone else's. You kind of used your own ideas and resources given to meddle with. It was great!*
- *I liked how we got to build the wind turbines without any restrictions and rules.*
- *I liked all of it but my favorite part was making windmills.*
- *I liked that we build the wind turbines and the mistakes we made we tried to fix the problem.*
- *I really liked the creativity and freedom that we could have when making the project.*

Once again, the EXPO was a big hit. We asked the girls to rate the EXPO and nearly all girls rated it highly, giving the EXPO a grade of 'A' (74%) or 'B' (24%). Twenty-eight percent of girls reported that the EXPO was their favorite or one of their favorite parts of the day. For example, some girls reported:

- *[I liked] exploring the EXPO and seeing all the stands.*
- *Today I really liked the EXPO because I liked operating the robots and seeing different types of engineering.*
- *[What] I enjoyed the most was EXPO. I had lot of fun doing experiments and getting free stuff.*
- *I liked walking around at the EXPO and learning about engineering.*
- *I really liked looking out around the EXPO and talking with all of the engineers. I thought that it was fun seeing them explain what they did as an engineer.*
- *[I liked] the EXPO interactions and connections with the real world.*
- *I liked the EXPO because I got to meet cool engineers and learn more things about colleges.*

The next most frequently reported “favorite aspect” of the event was using teamwork and working in groups (reported by 14%). For example, some girls reported:

- *I liked how we worked together to try to build the turbine. Also, I liked how we got to yell “EPIC FAIL” every time we failed.*
- *I liked spending time with others and working together. Engineering is also an important part of this event, and I liked that.*
- *Working together as a community creating and having fun.*
- *I like most of how we got to work as a group and got to rethink our design multiple times because of failed attempts we had.*
- *I enjoyed working with my partner on trying to figure out how to work the invention.*
- *[I liked] the teamwork and being fun making something and being able to see it work.*
- *I liked how [my partner and I] worked together. What else I liked was how everyone was encouraging each other.*

Another common response was that girls enjoyed the food (reported by 12% of girls). An additional 9% of the girls reported that one of their favorite parts of the event was meeting and working with new people. For example, some girls reported:

- *I liked how I got to work with someone I didn't even know. I got to know other people, and we worked well together. I liked the activities.*

- *I liked that I got to meet other girls and people from other schools and places.*
- *I liked how we got to work with new people we've never met.*
- *Working with (someone I didn't know) and being able to get our windmill to work.*

An additional 7% of the girls reported that one of their favorite aspects of the event was learning about engineers and what they do. For example, some girls reported:

- *I loved getting to learn about the different areas of engineering.*
- *I love how we get to meet other engineers from around the world and get to know them.*
- *I really enjoyed seeing all of the engineers and figuring out what they do and I also enjoyed the design challenge.*

To gather additional feedback on the activities, we asked the girls to rate the Wind Power Station activity. Nearly all girls rated the activity highly, giving it a grade of 'A' (71%) or 'B' (25%). Comments about the activity:

- *Really fun. Made a new friend.*
- *Really fun working with others.*
- *You get to know people and challenge yourself.*
- *I loved working was a team! It was awesome.*
- *Fun, but It would have been great If we had more time.*
- *I liked that it was very hands-on.*
- *Very fun/hard/creative.*
- *I loved building and testing ways to make the wind lift weights, especially building!*
- *The role models inspired me to become an engineer.*
- *Challenging with a hint of adventure.*
- *I loved it. At first, I didn't understand but I keep trying and found out it was really easy, and I learned from my mistakes.*
- *It was fun, but It would've been cooler to have a competition at the end.*
- *Very hands on and independent, but help was accessible.*

Most of the girls reported that they would recommend that other girls participate in events like IIBI (87%) and the remaining 13% said "maybe" they would.

Like last year, we asked five questions about the girls' experiences with the role models with which they worked during the event. Nearly all girls reported that the role models provided support and encouragement (98%), guided them during the activities (96%), were approachable (96%), and listened actively to the girls'

ideas (95%). Most of the girls reported that the role models inspired them to consider a career in engineering or technology (85%).

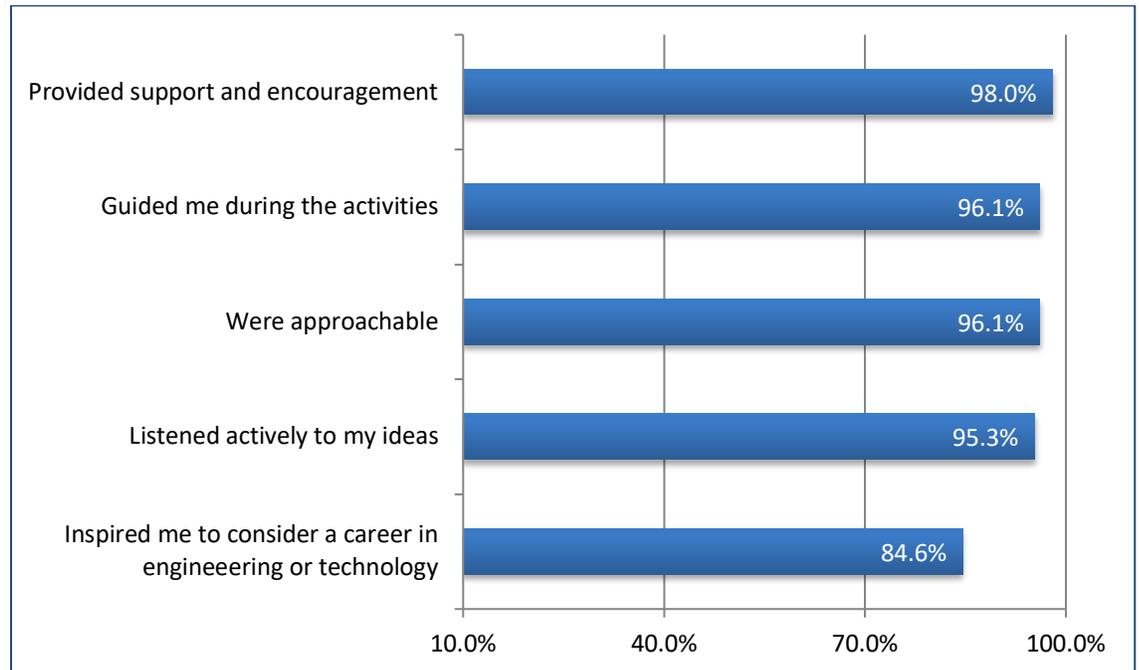


Figure 5. Proportion of girls' who reported improvements in engineering-related confidence and abilities after participating in the *Invent It. Build It.* event.

Role models handed out trading cards featuring female engineers during the EXPO. We asked the girls how many different trading cards they collected. Twenty-seven percent of the girls reported collecting 1 to 5 different trading cards, while 11% of the girls collected 6 to 10 cards and 5% of the girls collected more than 10 different trading cards. Fifty-seven percent of the girls reported that they did not collect any trading cards.

We asked the girls about their favorite demonstration during the EXPO. Eleven percent of the girls reported that they liked all of the demonstrations. Of the remaining girls who had a favorite, the most frequently reported favorite demonstrations are making the bouncy ball (22%), robot (6%), slime (5%), U.S. Army booth (5%), balloon (4%), and virtual reality (4%).

Suggestions for Improvement

We asked girls to tell us what they would change about the event, if they could. Of the 245 girls who answered, slightly more than a quarter (25%) reported that they wouldn't change anything about the event. For example, some girls reported:

- *I love this event. I would keep it the same.*

- *I would not change this event it was amazing the way it was.*
- *I believe that they did very good, at inspiring people to pick this as a career.*
- *I don't think I would because it was so much fun.*

The most frequently reported change that girls said they would make was to add activities (14%), For example, some girls reported:

- *I would provide more activities, otherwise, it's perfect.*
- *I would put in more hands-on projects.*
- *I would let the people do more activities because they are fun.*
- *I think I would have more time in the exhibition hall and do multiple engineering projects.*

Another popular response the girls gave was that they would add more time for the activities and the EXPO (11%). For example, some girls reported:

- *If possible, I would make or experimentation time longer.*
- *I would give kids more time to work on their projects.*
- *I would give people more time because we were rushing a lot towards the end.*
- *I would give a bit more time both at the convention & building the wind turbine.*
- *I think I would have more time in the exhibition hall and do multiple engineering projects.*
- *I would give more time to do this, because an hour time limit is a bit stressful and pressuring.*

Other aspects that girls reported they would change included better and more appropriate food options at lunch (9%), letting girls sit with and work wherever and with whomever they want (8%) and different activities (5%). For example, some girls reported:

- *More lunch choices.*
- *I would have vegetarian options and non-vegetarian options.*
- *I would change the lunch menu to something less fancy.*
- *I would give out better food and let people sit with their friends instead of choosing their spots.*
- *Put friends with friends or you get to be with the person you came with.*
- *I'd probably add an architecture part, along with more constructions. Architecture can be engineering.*
- *I'd make the activity something simpler but still challenging in a fun way based on the visitor's age group.*

- *I would add more things with technology like learning how to design an app.*
- *Have a more interesting project because mostly everyone has done the windmill project before.*

High School Girls

Attitudes and Beliefs about Engineering

Ninety-three percent of high school girls reported that they knew their families supported their interest in engineering or technology, which is up from last year (86%) and about the same as in 2016 (94%).

Ninety percent of high school girls reported that they felt empowered to find out more about engineering and technology if they wished, which is up from last year (83%) and the same percentage as in 2016 (90%).

Eighty-eight percent reported that they knew their friends would support their interest in engineering or technology, which is slightly up from last year (85%) and the same percentage as in 2016 (88%).

Eighty percent of high school girls reported that they saw a connection between their interests and passions and a career in engineering or technology, which is up from last year (76%) but down from 2016 (83%).

Twenty-four percent of high school girls reported collecting 1 to 5 different trading cards, while 9% of the girls collected 6 to 10 cards and 7% of the girls collected more than 10 different trading cards. Fifty-nine percent of the girls reported that they did not collect any trading cards.

We asked the girls about their favorite demonstration during the EXPO. Fourteen percent of the girls reported that demonstrations at various college booths were their favorite, followed by the U.S. Army demonstration (13%), the bouncy ball demonstration (8%) and the Google demonstration (6%).

Like last year, we also asked the girls if they were inspired by their role models to consider a career in engineering or technology. Eighty-nine percent of the girls agreed that their role models inspired them to consider an engineering or technology career which is an increase over last year (77%).

We did not ask these questions before girls attended the event, so it is possible that girls came to the event with these attitudes and beliefs already and we cannot conclude with certainty that the event itself impacted these beliefs.

Feedback on the Event

Nearly all high school girls rated the event highly, giving it a grade of 'A' (66%) or 'B' (31%). We asked girls what they liked most about the event. Sixty-one percent of the girls who responded reported that they liked the activities:

- *I liked the building activity because you got to collaborate and work with someone else and experiment on different ideas.*
- *I liked experimenting with the different materials and figuring out what worked.*
- *Making the robotic arm was fun and it was hard to do but very rewarding.*
- *I liked the hands-on activity because it really made you think. I also liked meeting all the engineers.*

Slightly more than one-third (36%) of the girls reported they enjoyed the EXPO:

- *I really liked the EXPO. There were so many people to talk to and learn about so many career paths and opportunities.*
- *I enjoyed participating in the STEM EXPO. Having the opportunity to engage with other girls gave me great insight on their views as engineers of the future.*
- *I really loved talking with colleges and employers because it gave me a lot of helpful info for my future. The hands-on activity was cool too.*
- *I really liked the specialized engineering booths, especially talking to engineers in fields I was interested in. I also liked the first Robotics booth because I do FTC robotics.*
- *The EXPO! It was fun to learn cool things in a laid-back manner! The free stuff was nice.*

Others valued the chance to meet other girls like them, with similar interests, as well as engineers working in the field:

- *Getting to see all the different types of engineering jobs and options. I also liked being able to connect with others who are also thinking about doing the engineering.*
- *I got to meet lots of new people. The volunteers were very friendly.*
- *[I liked] interacting with middle schoolers and college students.*

Others reported that they liked the role models:

- *It was a really nice environment. Everyone was really nice. I loved my role models so much.*

- *The volunteers and all the people I met! The first half of the day with all the booths were great!*
- *I got to meet lots of new people. The volunteers were very friendly.*

We asked high school girls to rate two distinct aspects of the event, the EXPO and the Hydraulic Activity (Ariel Biggs). Girls rated the Hydraulic Activity (Ariel Biggs) very highly, with most girls giving it a grade of 'A' (68%) or 'B' (25%). Some girls reported:

- *It was so fun and creative.*
- *[I] Enjoyed the trial and error process.*
- *Very challenging in an interesting way.*
- *Loved doing it! One of the most exciting things I've done at an extremely long time.*
- *Great speaker; has interesting/ fun connection to engineering (racing).*

Girls rated the EXPO highly, giving it a grade of 'A' (76%) or 'B' (20%). Some girls reported:

- *I really enjoyed it and loved exploring the stalls.*
- *Really cool to talk about different opportunities.*
- *I loved the interactive projects!*

Almost all girls reported that they would recommend that other students participate in events like IIBI (90% said "yes" with an additional 10% saying "maybe").

Suggestions for Improvement

When asked to report on what they could change about the event, if they were in charge, many reported that they would like clearer instructions for the activity:

- *Maybe give a little more direction for the project or more time.*
- *I would give us more information on hydraulics.*
- *Have the role models know more about the project and get more information.*
- *Give a little more time and specific instructions on what needs to be done.*

Other feedback included allowing for more time to complete the hands-on activities:

- *Given more time to do the experiment.*
- *Give more time for design challenge, less time to visit booths.*

- *Have more events at the EXPO and have more time for the build.*

Other suggestions included:

- *I felt like this program was not organized well. It was fun but felt like it ran too long.*
- *I would make the EXPO time either have more activities or shorter.*
- *I would let people change their seats and have the whole group work together instead of groups of two. That way everyone is comfortable but still meeting new people.*
- *Let people sit where they want.*
- *More personal stories of the different careers.*
- *I would have liked to explore other types of engineering like a session for computer engineering with coding or website designing.*

Parents and Educators

Feedback on the Event

The feedback from adults (engineers and non-engineers alike) who attended the event was very positive. All of the adults replied “yes” (96%) or “maybe” (4%) when asked if they would recommend the *Invent It. Build It.* event to others. As we observed the past three years, adults rated the event highly, with all but three adults giving it a grade of ‘A’ (78%) or ‘B’ (20%) this year.

We asked adults to rate each segment of the event with a grade. Most adults gave ‘A’ or ‘B’ ratings to each segment, even non-engineers (see Table 5).

**Table 4:
Adults’ Event Segment Ratings**

	Number and Percent (All adults)	Number and Percent (Non-engineers)
<i>EXPO</i>	N = 105	n = 90
A	69 (65.7%)	62 (68.9%)
B	32 (30.5%)	26 (28.9%)
C	3 (2.9%)	2 (2.2%)
D	1 (1.0%)	-
F	-	-
<i>Panel Discussion: Why Engineering?</i>	N = 104	n = 91

	Number and Percent (All adults)	Number and Percent (Non-engineers)
A	77 (74.0%)	69 (75.8%)
B	22 (21.2%)	17 (18.7%)
C	3 (2.9%)	3 (3.3%)
D	2 (1.9%)	2 (2.2%)
F	-	-
<i>Safe Landing Hands-on Activity</i>	N = 100	n = 87
A	61 (61.0%)	52 (59.8%)
B	27 (27.0%)	24 (27.6%)
C	6 (6.0%)	5 (5.7%)
D	5 (5.0%)	5 (5.7%)
F	1 (1.0%)	1 (1.1%)

We further analyzed the data from the panel discussion, by looking at ratings of parents (mother or father or guardian), troop leaders, and educators (see Table 5). The feedback on the panel discussion was very positive across all three participant groups, with all (100%) educators and troop leaders and almost all (94%) of parents and educators and all (100%) troop leaders giving a grade of 'A' or 'B'.

**Table 5:
Ratings of Panel Discussion by Parents, Educators and Troop Leaders**

	Number and Percent (Parents)	Number and Percent (Educators)	Number and Percent (Troop Leaders)
<i>Panel Discussion 1: Why Engineering?</i>	N = 86	N = 25	N = 19
A	63 (73.3%)	20 (80.0%)	13 (68.4%)
B	18 (20.9%)	5 (20.0%)	6 (31.6%)
C	3 (3.5%)	-	-
D	2 (2.3%)	-	-
F	-	-	-

Nearly all the participants, regardless of whether they were engineers, agreed or strongly agreed with the following statements:

- This event helped me learn where to find resources for girls/my daughter (93% of all adults, including non-engineers, consistent with the previous two years).
- I feel empowered to help more girls/my daughter become an engineer someday if they want to (95% of all adults and 96% of non-engineers, consistent with 2017 and a slight increase over 2016).
- This event helped me feel well-equipped to talk with girls/my daughter about a career in engineering (95% of all adults, including non-engineers, a slight decrease from 2017 and consistent with 2016).
- This event helped me understand why engineering is a good career choice (96% of all adults, including non-engineers, consistent with the previous year and an increase over 2016).
- This event helped me understand what engineers do (97% of all adults and 98% of non-engineers, representing an increase over the previous two years).
- I had a chance to meet professional engineers today (95% of all adults, including non-engineers, consistent with the previous two years).
- I had fun today (97% of all adults and 98% of non-engineers, consistent with the previous year and representing an increase over 2016).
- My goals were met today (91% of all adults, including non-engineers, consistent with the previous year and representing a significant increase over 2016).
- This event helped me to understand what it takes to become an engineer (90% of all adults and 91% of non-engineers, representing a significant increase over the previous two years).
- All my questions were answered today (86% of all adults and 84% of non-engineers, representing a slight increase over the previous year and a more significant increase over 2016).

As in previous years, parents were less likely to agree that the event helped them understand why there were so few women in engineering:

- This event helped me understand why there are so few women in engineering (71% of all adults and 74% of non-engineers, representing a slight decrease from the previous two years).

We asked adults to report what they learned at the event that they didn't know beforehand. The most popular response was that they learned about the wide range of engineering disciplines and careers that exist within the field of engineering (27%). For example, some adults reported:

- *[I learned that there are] 17 engineering fields! No idea that many.*
- *[I learned] how many different engineering jobs [you] can have.*
- *[I learned about] the large variety of engineering fields.*
- *Learned about business[es] that I was unfamiliar with that hire engineers.*
- *That a 4yr engineering degree can crossover but a 4yr science won't crossover to engineering.*

The second-most popular response (23%) was that adults generally learned about the various resources available to them. For example, adults reported they learned:

- *Additional resources/opportunities.*
- *Found new resources for teaching.*
- *Some programs that are available for middle/high school students.*
- *Student resources for STEM beyond what I've been using.*
- *The different programs available for girls in the engineering field.*

The third-most popular response (15%) was that adults learned about pursuing a college degree in engineering. For example, adults reported they learned:

- *Colleges pay for advanced degrees in science and engineering.*
- *Normandale has an [engineering] program that transfers to the U.*
- *Scholarship [information].*
- *That engineering students don't pick their major until sophomore year.*
- *You can be an engineer in just about any area of interest and you don't have to know which specific field you want to go into to begin working toward an engineering degree. Thank you! This is a great event.*

We asked the adults what features they liked most about the event. The most popular response was that adults liked the EXPO the best (38%). For example, some adults reported that they enjoyed:

- *[The] interactive booths and the EXPO, and information for parents to better understand the careers.*
- *[The] booths and educational materials. Kids loved hands-on activities & prizes.*
- *[That] my students were really engaged by the exhibitors and met every female engineer.*

- *[The] Q&A session. Girls able to ask [questions] during EXPO.*
- *Participatory events and exhibits the enthusiasm of all of the women engineers.*
- *The exhibit, especially engagement with SWE booths, companies and educational institutions around practical experiments that gave my daughter an "a-ha" moment and empowered with the "I can do this mentality."*
- *I loved the hands-on activities at the EXPO. My 8th grade daughter is skeptical about engineering. She learned that many of the things she loves to do are actually chemical engineering.*
- *[The] EXPO, getting to meet engineers from different companies, talking to women engineers and ask them what major/minor they took in college and what their job profiles are.*

The second-most popular response (19%) was that adults enjoyed learning from the panel. For example, some adults reported that they enjoyed:

- *[The] panel Q&A.*
- *Panel opinions & empowerment.*
- *I liked that there were so many areas of interest represented and the panel discussion - real answers to real questions by real people.*

Similarly, 15% of adults also mentioned that the access they had to engineers as what they liked the best. For example, some adults reported that they enjoyed:

- *Access to "actual" engineers who candidly answered our questions and express their love of engineering.*
- *That girls get a chance to be with engineer role models without parents to make active connections.*
- *Talking to engineers re: What they did and what their college experiences were.*
- *Getting to meet engineers from different companies, talking to women engineers and ask them what major/minor they took in college and what their job profiles are.*

Adults also appreciated the hands-on activities (15%) for both the girls and the adults. For example, some parents reported that they enjoyed:

- *Parents got to have some build time also.*
- *Safe landing exercise.*
- *The safe landing challenge was fun.*
- *Hands on experience, variety of topics, program for both parents as well as kids.*

- *The activities were engaging for our students and fun!*
- *Hands on projects and explanations of why things worked the way they did.*

Several adults (7%) mentioned that they appreciated the college and career information they received. They reported that they liked:

- *The combination of college options with career options.*
- *The opportunity for my Teen Tech Squad to see and explore the variety of work valuable in engineering fields.*
- *Very cool to have lots of younger engineers excited about their careers. Hearing about the many possible internships that are available.*
- *Meeting engineers, employers, colleges.*

Other specific aspects of the event that adults appreciated were:

- The empowering message for girls (6%),
- Support for girls in STEM (5%),
- That the girls learned about engineering (5%), and
- The mix between information and interactivity of the event (5%).

Eighteen percent of adults reported collecting 1 to 5 different trading cards, while 6% of the adults collected 6 to 10 cards and 3% of the adults collected more than 10 different trading cards. Seventy-four percent of adults reported that they did not collect any trading cards.

Suggestions for Improvement

We asked adults to make suggestions for enhancing the event. Eleven percent reported that they would not change anything about the event. Of the adults who did make suggestions, 35% reported that they would like more information across a variety of areas. Some adults suggested:

- *Distribute list of exhibitors with contact information.*
- *More detailed signage directing people where and when to go.*
- *I would like one sheet with activities/resources from each presenter at EXPO. A compilation of websites like CSFirst curriculum.*
- *Add a path to STEM summer camp, at all financial levels.*
- *Talk more about colleges and college requirements.*
- *Expand the program to include details of volunteer/internship programs for girls in Engineering degrees/jobs/fields.*

- *I would discuss a path to make engineering practical experiences more accessible to ethnically diverse and lower socio-economic groups in both lower ed and higher ed. Huge gap in accessibility here.*
- *I heard there was an ice cream social and other events this week. I only heard of today's events prior to arriving today. Maybe publicize more of the opportunities.*

Eight percent of those who made suggestions for improvement reported that the event volunteers could have been more prepared to execute the logistics of the event.

- *Expedite the check in process- our names were not submitted and had to be printed on the spot.*
- *The check-in/registration process needs to be improved. The line was long, the processing was slow, and the workers asked uninformed questions like "Is this all you are supposed to get" I said, "You tell me".*
- *Logistics for moving girls to their program were so-so. SWEngo - have it if you advertise it.*
- *Improve guidance when we enter hall - we didn't know what to do.*

Another eight percent of adults suggested improvements to the logistics around lunch. Some adults suggested:

- *Lunch - Did not like having groups split. My daughter has food needs and when asked if she had been given the gluten free option was told that they were taking care of the parents and not the kids. I won't know until the program is over if she was able to have lunch.*
- *Separate ticket or line for vegetarian/BF food options, otherwise, everything was great.*
- *Having lunch together. We were not expecting to be split so soon. Honestly the parent part seemed most disorganized. Also, my girls were put on different teams - needed something in registration to pair them. People shouting "shut the doors" is a pretty rude ending.*
- *Gluten free food area, more high school activities.*

Six percent of those who made suggestions for improvement reported they would add more time and activities/interactions for the EXPO. Some adults suggested:

- *Encourage all exhibitors to offer some sort of activity. It really made the difference. Additionally, the SWE rep booths with all the different types of engineers seemed too bare bones- it wasn't clear that they were there as a Q&A type role.*
- *Even more EXPO time (maybe give a 2nd day we could come back if we don't finish).*

- *More hands-on experiments - each booth should be encouraged to have one. Encourage booth participants to explain words used (i.e., components) so students could understand if had no prior knowledge.*

Another six percent of adults who made suggestions for improvements indicated that they would like the adult sections of the event to be broken out by role (parent, educator, etc.) or by age of student (high school versus middle school). Other suggestions for improvement included:

- *Shorter event (6%),*
- *More time, in general (5%),*
- *Larger space (3%),*
- *More diversity of engineers in attendance (3%) and,*
- *In the booths with both male and female exhibitors, males always seemed to be the leader...need a more consistent messaging around female leadership.*

For example, some adults reported:

- *A little too long - the EXPO was great but overwhelming after 2 hrs.*
- *More capacity/less crowding/more time for kids to see activities.*
- *Larger space for more tables of same activity.*
- *Presenters kept saying show them engineers that look like them-there was not one Latina engineer here, at least not readily available.*
- *EXPO booths that had men and women were led by the men (at least majority that were coed). Coed booths should demonstrate women leaders. (CIA booth biggest disappointment on this) Panel - "If you can't see it you can't leave it" we need to see women leading where men are involved.*

EXPO Exhibitors

Feedback on the Event

EXPO Exhibitors rated the EXPO positively, giving it a grade of 'A' (77%) or 'B' (23%), an increase over last year where exhibitors rated it 'A' (34%) or 'B' (48%), and an increase over 2016 where exhibitors rated it 'A' (37%) or 'B' (59%).

Most of the exhibitors (85%) agreed or strongly agreed that the set-up and tear down of the booth went smoothly. Almost all of the exhibitors (96%) enjoyed interacting with the adults and children who visited their booths. Ninety-six percent of exhibitors enjoyed the fact that this was an event for girls.

Most of the exhibitors (87%) agreed or strongly agreed that they would be interested in exhibiting at other SWE conferences, local or national. In addition, 71% of exhibitors agreed or strongly agreed that the registration went smoothly.

A majority of exhibitors agreed or strongly agreed that their booth received enough interest and foot traffic (94%), that the on-site check in process was helpful (67%), and that SWE's IIBI EXPO compares favorably with others where they have exhibited (60%). Finally, less than half (42%) of exhibitors agreed that the fee for exhibitor registration was reasonable.

We asked exhibitors what they liked most about the EXPO. Over a third (35%) liked interacting with the girls. They reported:

- *Great and important event for us. We love participating and interacting with the girls every year.*
- *[I liked the] engagement from students, best one yet.*
- *[I liked] talking to all the kids & parents.*
- *I liked the demonstrators standing in front of tables and the parents encouraging the students to talk/interact.*

Similarly, slightly over one third (35%) of exhibitors noted the turnout at the event and liked the level of enthusiasm and engagement among the attendees. They commented:

- *[I liked] the kids and their excitement and enthusiasm. Very well-organized event.*
- *Lots of kids. Loud and colorful. Lots of resources. It was like a fair.*
- *Engaged students - lots of them.*
- *Lots of participants who seemed excited. Everyone seemed motivated and encouraging.*

In addition, nineteen percent of the exhibitors liked the variety of hands-on activities. They liked:

- *[The] diversity of activities.*
- *The variety of activities the girls could do and getting to interact with them.*
- *We enjoyed the quality of turn out. The experiments chosen highlighted key skill sets of the organization.*
- *Interactive, engaging - the kids seemed to really like hands on activities.*

Another thirteen percent of exhibitors noted that the variety of exhibitor booths as something they enjoyed. For example, some reported they liked:

- *Diversity of booths and activities, bright colors.*
- *Variety of organizations.*
- *All the different options for students.*

Ten percent of the exhibitors liked the facilities. They noted:

- *Good interaction with the students. Well organized. It was warm in here! Soft flooring to stand on!*
- *A lot of open space for everyone, the colorful entrance and fun environment and hands on activities.*
- *Good space and lighting.*

Another eight percent of exhibitors like that the event was well-organized. Some reported:

- *The turnout was great. The organizers were well coordinated and did a great job communicating updates.*
- *Well organized.*

Other comments from exhibitors included:

- *[I liked the] traffic, [and that it] focused on kids.*
- *It was a fun environment for the girls.*

Suggestions for Improvement

We asked exhibitors how they would change the EXPO for the future. Slightly more than one quarter (26%) of the exhibitors would like to make improvements to the logistics related to their booth. Suggestions and comments included:

- *Our booth was kind of in the middle of the floor which was a little confusing to visitors. This layout did not work for our demonstration. It was also really hard to get info on available outlets and we had to change our plan to remove electric requirements due to lack of info.*
- *Provide outlet.*
- *Vendors were challenging to work with. No one knew who to call for AV - total mess!*
- *More clear instructions for load-in.*
- *More encouragement for attendees to visit the College Row and a sign to direct traffic that way.*

Fifteen percent of exhibitors would like more space at their booth and eleven percent would like more time for the event. Other suggestions from exhibitors included:

- *More media coverage.*
- *More high school females. Longer time.*
- *Would like a reception of all exhibitors to meet other exhibitors.*
- *More info beforehand on what is expected of us.*

Appendix A: Scheduled Events and Activities

The Society of Women Engineers Presents

Invent it. Build it.

AN ENGINEERING EXPERIENCE FOR MIDDLE AND HIGH SCHOOL GIRLS, PARENTS AND EDUCATORS

SATURDAY

10.20.18

MINNEAPOLIS CONVENTION CENTER

**EXPO
9 AM -
12 PM**



Attendees should arrive promptly at 9 AM. Everyone starts the day exploring the EXPO and will split up into their own program at 12 PM.

Get information about engineering clubs, camps, after-school programs, competitions, best practices, outreach grants and more. There will be lots of fun hands-on activities!

Financial and transportation assistance available upon request at inventitbuildit@swe.org

MIDDLE SCHOOL GIRLS PROGRAM: \$7*



12 PM - 4 PM

GIRLS IN GRADES 6-8

Work with women engineers on hands-on engineering activities. Express your creativity and learn how engineers make the world a better place.

HIGH SCHOOL GIRLS PROGRAM: \$7*



12 PM - 4 PM

GIRLS IN GRADES 9-12

Connect with engineers from all over the world to learn about what they do and how to be successful, receive tips on selecting the right college, and take on an engineering challenge!

PARENT EDUCATION PROGRAM (PEP): \$5*



12 PM - 4 PM

PARENTS & EDUCATORS

Learn about engineering careers, scholarships, college admission and other helpful resources to support your students.

**Registration is required. Lunch and t-shirt provided. Attendees will be responsible for parking fees.*

Get More Information

Visit inventitbuildit.swe.org or email inventitbuildit@swe.org

Invent it. Build it. is made possible through a generous grant from The ExxonMobil Foundation.



MAKE A WORLD OF DIFFERENCE

#BETHATENGINEER

Get ready to learn what engineers do, the positive impact they have on people everywhere and how they make a world of difference.

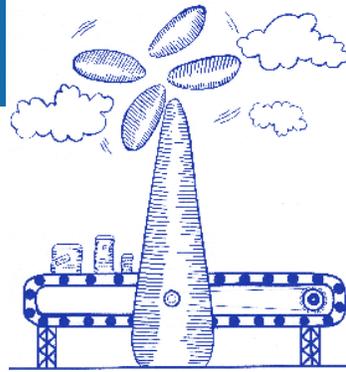
Appendix B: Activity Sheets

WIND POWER STATION

CHALLENGE SHEET

YOUR CHALLENGE

Design a machine that lifts heavy objects using only the wind!



FOR MORE GREAT ACTIVITIES:
PBSKIDS.ORG/DESIGNSQUAD

50 minutes / Ages 10

MATERIALS

(per person or team)

- 1 – 2 wooden skewers
- plastic soda bottle with plastic cap
- scrap pieces of cardboard
- cardboard box
- straw
- scissors
- duct tape
- pencil/pen and scrap paper

(for testing)

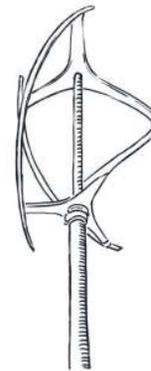
- portable electric fan, large piece of cardboard (to create wind), or access to the outdoors
- spool of thread
- 3 paperclips (to hold up the weights on the string)
- 3 small bags (to hold sand or weights)
- sand, metal washers, or other weights

DEFINE THE NEED

Engineers all over the world are working on building machines that generate power to do work without burning fossil fuels like coal and oil, that add to climate change and pollute the air. Wind turbines get energy from the wind to do all kinds of tasks like irrigating farm fields, grinding grain, sawing wood or even generating electricity by connecting to an electric generator.



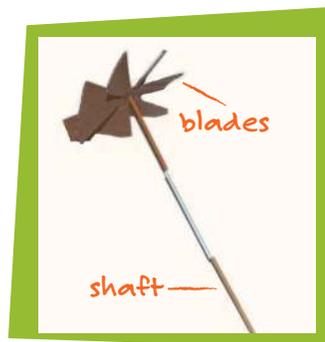
3-BLADED TURBINE
good for strong, steady wind, high off the ground



MODERN VERTICAL AXIS TURBINE
good for low-to-the-ground and gusty winds

BRAINSTORM & DESIGN

- **Design a wind turbine that can lift a weight.**
- The most important parts of a wind turbine are the **blades** and **shaft**.
- **All** blades should be curved in the same direction. They spin in a circle when the wind blows. The blades turn the shaft to provide energy to do something useful.
- Sketch your design on a piece of paper.



BUILD

- **Look over all the materials before you begin.** Could you build a wind turbine out of cardboard or use plastic from the bottle? Could you use the straw to improve the function?

- Many designs are possible, and there are no right or wrong ways of building a wind turbine. Engineers and inventors are still trying to figure out the best way to capture energy from the wind.
- What would you use to build a structure or tower to hold your blades and shaft?
- What size and shape of a blade would get the most wind?

TEST, EVALUATE, & REDESIGN

- If your wind turbine spins, try to stop the shaft with your fingers. If it is a little hard to stop, your wind turbine provides good **torque**. Torque is a twisting or turning force.
- Attach a small bag of sand or weights to see if your wind turbine can lift it. The heavier the weight, the more torque your wind turbine provides.

TESTING CHECKLIST

- Shaft spins
- you feel the torque in your fingers
- lifts weight
Describe the weight:
how much, what kind?

• Which tests does your power station pass?

- **Redesign:** Change the size of the blades, the number of blades, and other things about your machine to give it more torque—and make it lift more weight.

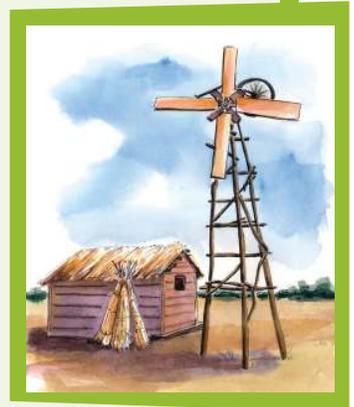
Problem-Solving Tips

- **Blades don't move?** Check the shape and size of your blades. Remember they all should be the same direction, and they need to be large enough to harness the wind!
- **Shaft doesn't spin?** Check how your shaft is connected to your blades. Make sure there isn't friction preventing the shaft from turning!
- **Whole thing falls over?** Maybe your base is too small. Make it wider and sturdier to sustain high wind!

ENGINEERING AND INVENTION IN ACTION



In Malawi, East Africa, a 14-year-old boy named William Kamkwamba solved a serious problem for his family. He and his 7 sisters could not get electricity unless they burned kerosene fuel in a generator. The generator created a lot of smoke and sometimes broke down. William built a wind turbine out of an old bicycle, some trees, and pieces of plastic pipe. He used bicycle gears to speed up his turbine's shaft to generate electricity. To get more power, William made another wind turbine with more blades. Next, he built a much larger wind turbine that pumped water to the village's corn fields. "It was a simple machine that changed my life," he said. William's advice for other young inventors: "Trust yourself."



MAJOR FUNDING
The Lemelson Foundation
Inspiring Kids Through Invention

ADDITIONAL FUNDING
UL

NCEES
addressing barriers for engineers and engineers

INNOVATIVE EDUCATION AWARDS
recognizing innovative educators

WGBH

Design Squad Global is produced by WGBH Boston.

Major funding is from the Lemelson Foundation. Project funding is provided by United Engineering Foundation (UEF), the National Council of Examiners for Engineering and Surveying (NCEES), and the UL Innovative Education Award.

TM/© 2018 WGBH Educational Foundation. All rights reserved.



Braking Caliper Development Project

Table of Contents

3. Challenge Overview
4. 4-Stage Rotor Dock Assembly
6. Caliper Material Cost
7. Sample Single Piston Base Caliper Assembly
13. Test Results Table



Challenge Overview

AB Racing Inc. has developed a new metal brake rotor compound. The new compound is stronger, more heat resistant and lighter than any other on the performance market. AB Racing Inc. has commissioned your team to design a new hydraulic brake caliper, fluid and pad combination for their rotor.

You have been given a budget and a few tools to engineer the new caliper system, these are described below:

Budget: \$100,000

4-Stage Electrical Testing Dock

- One new rotor
 - Stand
 - Batteries
 - Small Motor
- *some assembly required

Your work station is shared with one other engineering team. The electrical testing dock will also be shared. Based on the best performance results of both teams caliper design one team will receive the project commission.

Good Luck!



4-Stage Electrical Testing Dock Set-Up

Materials:

- 1x Small DC Motor
- 1x AB Racing Rotor
- 2x Paint Stir Sticks
- 1x Mini Fan
- 1x Cardboard Stand
- 1x Motor Dock
- 1x 4-Cell Battery Case
- 4x AA Batteries
- Duct Tape

Step 1: tape paint sticks to stand



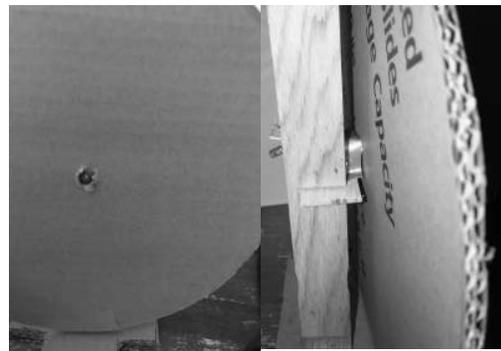
Step 2: insert and secure motor dock



Step 3: secure motor to dock

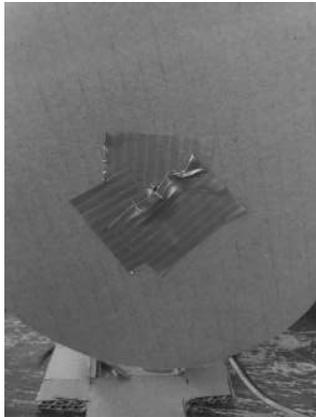


Step 4: insert rotor on motor driveline



4-Stage Electrical Testing Dock Set-Up

Step 5: lock fan on to outer side of rotor and secure with tape



Step 6: tape empty battery cell case to base of stand

Step 7: hook tightly copper wire to metal tabs on top of motor
*the copper that touched the metal tab the better the connection



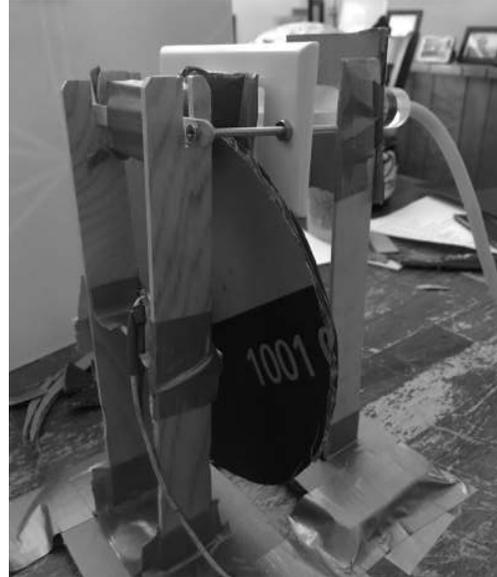
For best results tape the foundation of your testing dock to the table.

Materials and Cost

\$100	Paint Sticks
\$8,000	2oz Syringe
\$12,000	0.5oz Syringe
\$100/ft	Latex Tubing
\$1,000	Screws
\$500	Nuts
\$5,000	Popsicle Sticks
\$1,000	Brake Pads
\$2,000/Syringe	Water
\$5,000	Oil #1
\$8,000	Oil #2
\$5,000	Cardboard 11x8 Piece
\$7,000/Sheet	Sand Paper Fine Grit
\$10,000/Sheet	Sand Paper Medium Grit
\$15,000/Sheet	Sand Paper Coarse Grit
\$3,000	Electrical Outlet Cover
\$2,000	Wooden Dowel



Sample Single Piston Caliper Base Assembly



Step 1: brainstorm and draw caliper design ideas

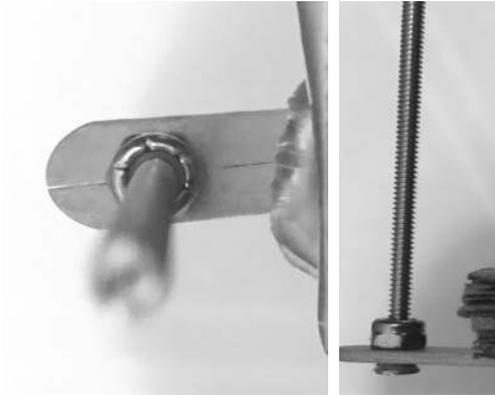
Step 2: tape two cardboard pads
on one popsicle stick

Step 3: covering as little
sand paper as possible
secure it to pads

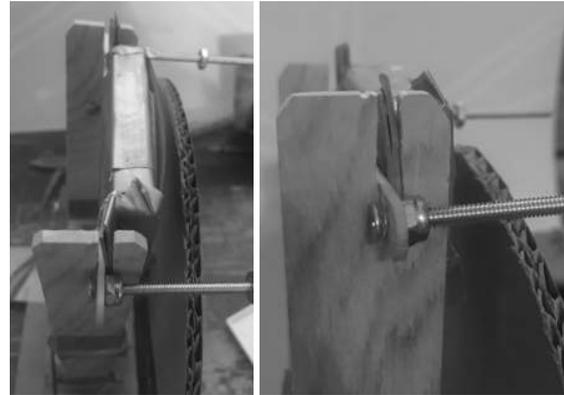


Sample Single Piston Caliper Base Assembly

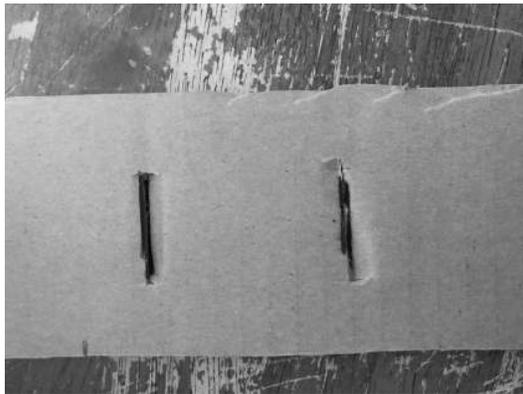
Step 4: Place screws through holes in
popsicle sticks and secure with nuts



Step 5: Insert pad in to notch in
rotor stand



Step 6: Cut out cardboard base for
caliper stand



Step 7: Secure paint sticks to caliper
stand



Sample Single Piston Caliper Base Assembly

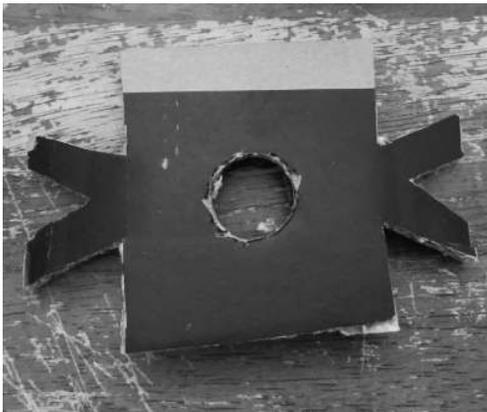
Step 8: run nuts on screw ends, then slide on electrical outlet



Step 9: By adjusting the first screws position, set electrical outlet roughly inch distance from pads on popsicle stick



Step 10: Cut out designed syringe holder

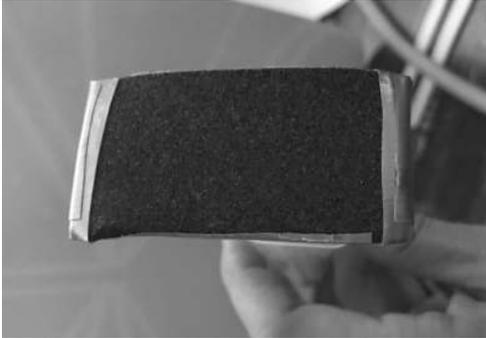


Step 11: Secure second set of pad to handle side of syringe

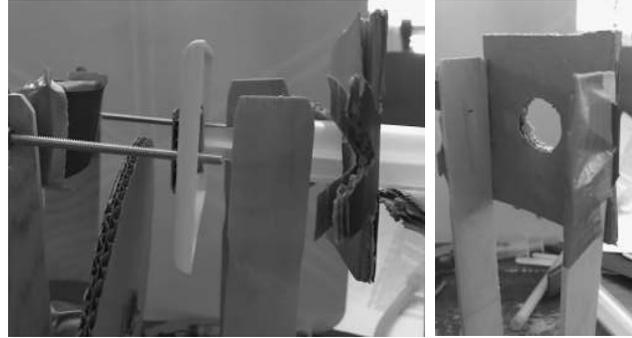


Sample Single Piston Caliper Base Assembly

Step 12: secure sand paper to pads on syringe cover as little surface as possible



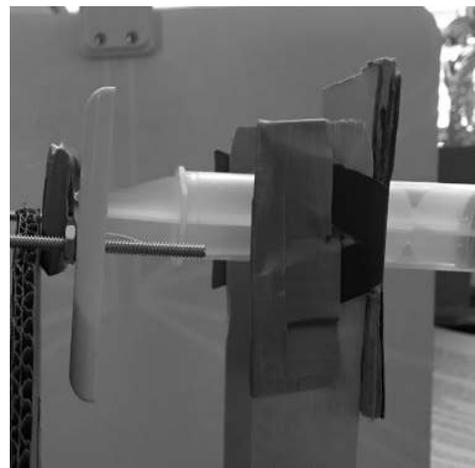
Step 13: secure holder to caliper stand using syringe to help align with electrical outlet



Step 14: fill largest syringe with fluid then fit latex tubing over the filler end of the syringe

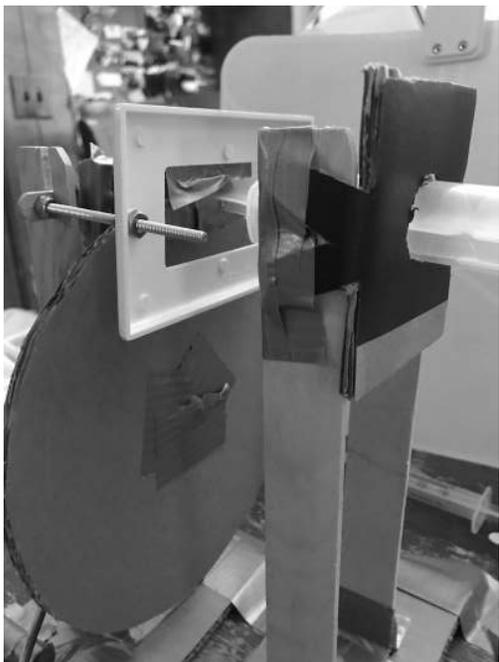
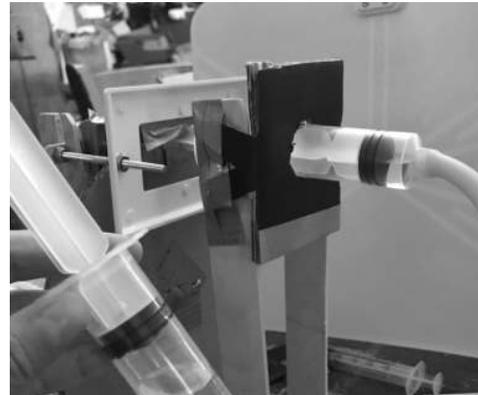
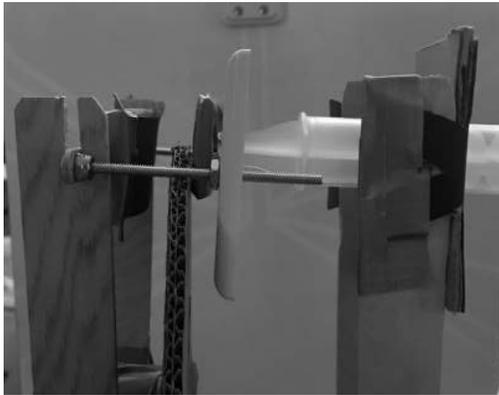


Step 15: fit syringe with pads in holder



Sample Single Piston Caliper Base Assembly

Step 16: set entire caliper assembly in rotor testing dock



Sample Single Piston Caliper Base Assembly

Step 17: turn on rotor by inserting first battery in to cell case

Step 18: allow rotor to get up to speed, approximately 15 sec

Step 19: have one team member start a stopwatch as another moves the fluid from the syringe not connected to the pads (master cylinder) to the syringe connected to the pads (caliper piston)

Step 20: stop time as soon as rotor stops, Record in table on the next page, remove battery

Step 21: repeat 17-20 with second team

Step 22: repeat 17-21 3 more times adding one more battery each time until you have tested with all four

The winning team will be decided based on best rotor stopping time with my most batteries or upon the failure of other teams caliper



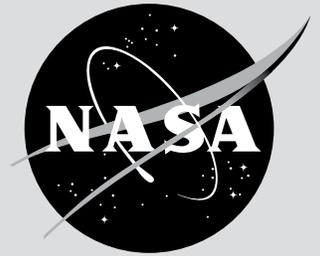
Test Results

# of Batteries	Time
1	
2	
3	
4	

Total Cost:



TOUCHDOWN



Landing on the moon is tricky. First, since a spacecraft can go as fast as 18,000 miles per hour (29,000 km/hour) on its way to the moon, it needs to slow way down. Then it needs to land gently. That lander has astronauts inside, not crash-test dummies. Easy does it!



WE CHALLENGE YOU TO...

...design and build a shock-absorbing system that will protect two "astronauts" when they land.

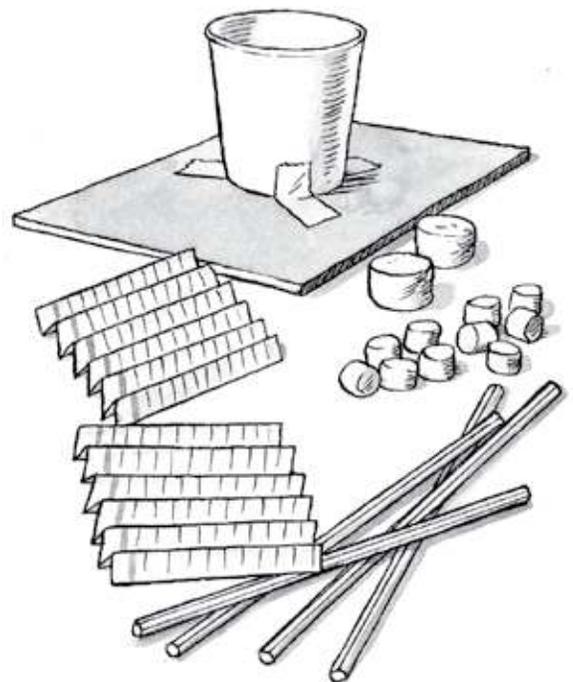
BRAINSTORM AND DESIGN

Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing?
- How will you make sure the lander doesn't tip over as it falls through the air?

BUILD

- 1. First, design a shock-absorbing system.**
Think springs and cushions.
- 2. Then, put your spacecraft together.**
Attach the shock absorbers to the cardboard platform.
- 3. Finally, add a cabin for the astronauts.**
Tape the cup to the platform. Put two astronauts (the large marshmallows) in it.
(NOTE: The cup has to stay open—no lids!)



A lander under construction

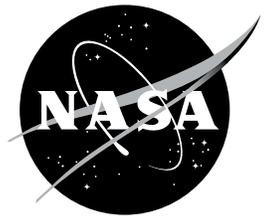
MATERIALS (per lander)

- 1 piece of stiff paper or cardboard (approximately 4 x 5 in/10 x 13 cm)
- 1 small paper or plastic cup
- 3 index cards (3 x 5 in/8 x 13 cm)
- 2 regular marshmallows
- 10 miniature marshmallows
- 3 rubber bands
- 8 plastic straws
- scissors
- tape

TEST, EVALUATE, AND REDESIGN

Ready to test? Drop your lander from a height of one foot (30 cm). If the “astronauts” bounce out, figure out ways to improve your design. Study any problems and redesign. For example, if your spacecraft:

- **tips over as it falls through the air**—Make sure it’s level when you release it. Also check that the cup is centered on the cardboard. Finally, check that the weight is evenly distributed.
- **bounces the astronauts out of the cup**—Add soft pads or change the number or position of the shock absorbers. Also, make the springs less springy so they don’t bounce the astronauts out.



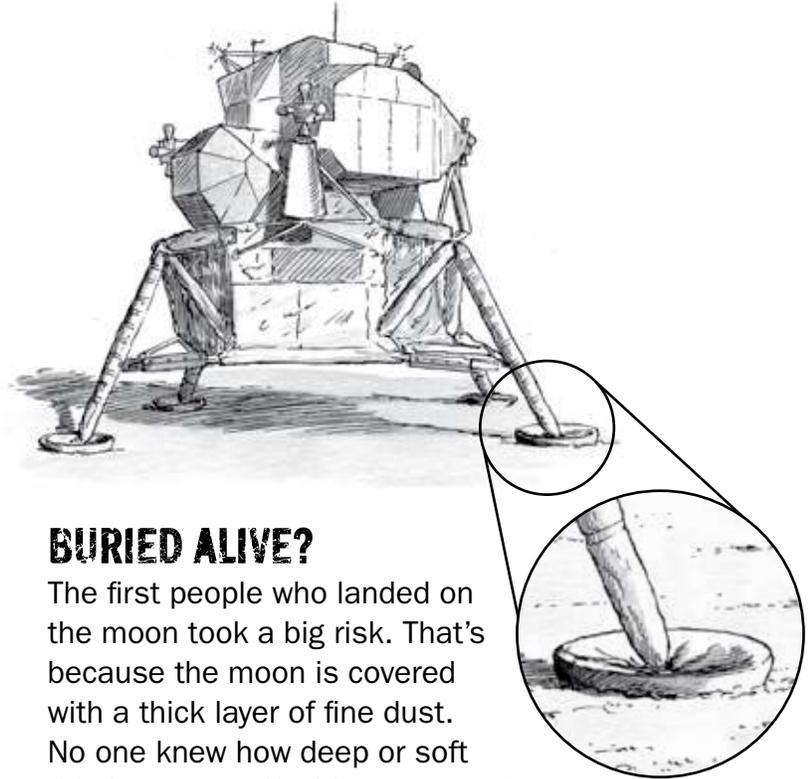
Check out NASA's moon missions at moon.msfc.nasa.gov.



THE COOLEST JOB AT NASA

When people asked Cathy Peddie what she wanted to do when she grew up, she would point at

the sky and say, “I want to work up there!” Now an engineer at NASA, she manages the Lunar Reconnaissance Orbiter (LRO) project. She calls it “the coolest job at NASA.” LRO will orbit the moon for at least a year and collect information to help NASA prepare for having people live and work there. Hear her describe the mission at: learners.gsfc.nasa.gov/mediaviewer/LRO.



BURIED ALIVE?

The first people who landed on the moon took a big risk. That’s because the moon is covered with a thick layer of fine dust. No one knew how deep or soft this layer was. Would a spacecraft sink out of sight when it landed? Now we know—the layer is firm. In the picture, you can see that Apollo 11’s lander pads sank only about 2 inches (5 cm) into the dust. What a relief! This helped NASA figure out the kinds of shock absorbers and landing systems its spacecraft need.

Only 12 people have ever visited the moon. But someday soon NASA plans to have teams of astronauts living there for six months at a time.



Watch **DESIGN SQUAD** on PBS or online at pbs.org/designsquad.



Major funding for *Design Squad* provided by



A private corporation funded by the American people



Education

Additional funding for *Design Squad* provided by



Design Squad is produced by WGBH Boston. *Design Squad*, AS BUILT ON TV, and associated logos are trademarks of WGBH. All rights reserved. This NASA/*Design Squad* challenge was produced through the support of the National Aeronautics and Space Administration (NASA).



For more information about NASA missions and educational programs, visit nasa.gov.

Appendix C: Survey Instruments

Invent It. Build It. – Student Feedback Form

Thank you for your participation. Please take a few minutes to fill out this survey.

Your comments and ideas will help make this event better in the future.

1. What grade would you give today’s event? Please circle the letter to show your answer.

A	B	C	D	F
----------	----------	----------	----------	----------

2. What did you like most about the event today? What else did you like?

3. Please circle a number by each statement to indicate how much you agree with the statement about today’s event.

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Before this event, I knew what an engineer did.	1	2	3	4	5
After this event, I know what an engineer does.	1	2	3	4	5
I see a connection between my interests/passions and a career in engineering or technology.	1	2	3	4	5
I feel empowered to find out more about engineering and technology if I want to.	1	2	3	4	5
Before this event, I was interested in becoming an engineer.	1	2	3	4	5
After this event, I am interested in becoming an engineer.	1	2	3	4	5
My friends would support my interest in engineering or technology.	1	2	3	4	5
My family would support my interest in engineering or technology.	1	2	3	4	5
My ability to think of different ways to solve a problem improved.	1	2	3	4	5
My confidence in problem solving improved.	1	2	3	4	5
My confidence in designing things improved.	1	2	3	4	5
My confidence in building things improved.	1	2	3	4	5

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Engineers are creative.	1	2	3	4	5
Engineers do work that is hands-on.	1	2	3	4	5
Engineers do work that is fun.	1	2	3	4	5
Engineers do work that allows them to help their community and/or society.	1	2	3	4	5
Engineering and technology are good career choices for women.	1	2	3	4	5
The role models I worked with listened actively to my ideas.	1	2	3	4	5
The role models provided support and encouragement.	1	2	3	4	5
The role models were approachable.	1	2	3	4	5
The role models guided me during the activities.	1	2	3	4	5
The role models inspired me to consider a career in engineering or technology.	1	2	3	4	5

4. If you were in charge, how would you change this event?

5. Would you recommend that other kids participate in events like this?

- a. Yes
- b. Maybe
- c. No (please explain): _____

6. Please rate each segment of today's event by circling a letter grade. Add any comments you have.

EXPO	A	B	C	D	F
-------------	---	---	---	---	---

Comments: _____

Wind Power Station Activity	A	B	C	D	F
------------------------------------	---	---	---	---	---

Comments: _____

7. What grade are you in? _____
8. Are you a member of SWENext? a. Yes b. No c. Unsure
9. Are you a member of a SWENext Club? a. Yes b. No c. Unsure
10. With what races or ethnicities do you most identify? (Choose all that apply.)
- a. White or European American
 - b. Hispanic, Latino, or Spanish
 - c. Black or African-American
 - d. Asian American
 - e. Native Hawaiian or Pacific Islander
 - f. Native American or Alaskan Native
 - g. Other: _____
 - h. Prefer not to answer
11. During the EXPO, how many DIFFERENT trading cards did you collect?
- a. None b. 1-5 c. 6-10 d. > 10
12. During the EXPO, what was your favorite booth or demonstration? Leave blank if you did not view any demonstrations or did not have a favorite.
-
-

Thanks very much for your help! Please hand in your completed survey.

Invent It. Build It. – High School Student Feedback Form

Thank you for your participation. Please take a few minutes to fill out this survey.

Your comments and ideas will help make this event better in the future.

1. What grade would you give today’s event? Please circle the letter to show your answer.

A	B	C	D	F
----------	----------	----------	----------	----------

2. What did you like most about the event today? What else did you like?

3. Please circle a number by each statement to indicate how much you agree with the statement about today’s event.

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Before this event, I knew what an engineer did.	1	2	3	4	5
After this event, I know what an engineer does.	1	2	3	4	5
I see a connection between my interests/passions and a career in engineering or technology.	1	2	3	4	5
I feel empowered to find out more about engineering and technology if I want to.	1	2	3	4	5
Before this event, I was interested in becoming an engineer.	1	2	3	4	5
After this event, I am interested in becoming an engineer.	1	2	3	4	5
My friends would support my interest in engineering or technology.	1	2	3	4	5
My family would support my interest in engineering or technology.	1	2	3	4	5
My ability to think of different ways to solve a problem improved.	1	2	3	4	5
My confidence in problem solving improved.	1	2	3	4	5
My confidence in designing things improved.	1	2	3	4	5
My confidence in building things improved.	1	2	3	4	5

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Engineers are creative.	1	2	3	4	5
Engineers do work that is hands-on.	1	2	3	4	5
Engineers do work that is fun.	1	2	3	4	5
Engineers do work that allows them to help their community and/or society.	1	2	3	4	5
Engineering and technology are good career choices for women.	1	2	3	4	5
The role models I worked with listened actively to my ideas.	1	2	3	4	5
The role models provided support and encouragement.	1	2	3	4	5
The role models were approachable.	1	2	3	4	5
The role models guided me during the activities.	1	2	3	4	5
The role models inspired me to consider a career in engineering or technology.	1	2	3	4	5

4. If you were in charge, how would you change this event for the future?

5. Would you recommend that other students participate in events like this?

- a. Yes
- b. Maybe
- c. No (please explain): _____

6. Please rate each segment of today's event by circling a letter grade. Add any comments you have.

EXPO	A	B	C	D	F
-------------	---	---	---	---	---

Comments: _____

Hydraulic Activity (Ariel Biggs)	A	B	C	D	F
---	---	---	---	---	---

Comments: _____

7. What grade are you in? _____
8. Are you a member of SWENext? a. Yes b. No c. Unsure
9. Are you a member of SWENext Club? a. Yes b. No c. Unsure
10. With what races or ethnicities do you most identify? (Choose all that apply.)
- a. White or European American
 - b. Hispanic, Latino, or Spanish
 - c. Black or African-American
 - d. Asian American
 - e. Native Hawaiian or Pacific Islander
 - f. Native American or Alaskan Native
 - g. Other: _____
 - h. Prefer not to answer
11. During the EXPO, how many DIFFERENT trading cards did you collect?
- a. None b. 1-5 c. 6-10 d. > 10
12. During the EXPO, which was your favorite booth or demonstration? Leave blank if you did not view any demonstrations or did not have a favorite.

Thanks very much for your help! Please hand in your completed survey.

Invent It. Build It. – Adult Participant Feedback Form

Thank you for your participation. Please take a few minutes to fill out this survey.

Your comments and ideas will help make this event better in the future.

1. What grade would you give today’s event? Please circle the letter to show your answer.

A	B	C	D	F
----------	----------	----------	----------	----------

2. What did you like most about the event today? What else did you like?

3. Please circle a number by each statement to indicate how much you agree with the statement about today’s event.

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Before this event, I knew what an engineer did.	1	2	3	4	5
After this event, I know what an engineer does.	1	2	3	4	5
This event helped me feel well-equipped to talk with girls/my daughter about a career in engineering.	1	2	3	4	5
This event helped me understand why engineering is a good career choice.	1	2	3	4	5
This event helped me understand what it takes to become an engineer.	1	2	3	4	5
This event helped me understand why there are so few women in engineering.	1	2	3	4	5
This event helped me learn where to find resources for girls/my daughter.	1	2	3	4	5
I had a chance to meet professional engineers today.	1	2	3	4	5
I feel empowered to help girls/my daughter become an engineer someday if they want to.	1	2	3	4	5
My goals were met today.	1	2	3	4	5
All my questions were answered today.	1	2	3	4	5
I had fun today.	1	2	3	4	5

4. If you were in charge, how would you change this event for the future?

5. Would you recommend that others participate in events like this?

- a. Yes
- b. Maybe
- c. No (please explain): _____

6. Please rate each segment of today's event by circling a letter grade. Add any comments you have.

EXPO	A	B	C	D	F	Did not attend
-------------	---	---	---	---	---	----------------

Comments: _____

Panel Discussion: Why Engineering?	A	B	C	D	F	Did not attend
---	---	---	---	---	---	----------------

Comments: _____

Safe Landing Hands-on Activity	A	B	C	D	F	Did not attend
---	---	---	---	---	---	----------------

Comments: _____

7. What is your relationship to the girl(s) participating in the event today? (Choose all that apply.)

- a. Mother
- b. Father
- c. Guardian
- d. Troop Leader
- e. Teacher
- f. Other _____

8. Are you in the education field, such as a counselor, administrator, or teacher? Please indicate the level of students you work with. (Choose all that apply.)

- a. Pre-K
- b. Elementary
- c. Middle School
- d. High School
- e. College
- f. Other _____
- g. I am not in the education field

9. How are you affiliated with SWE? (Choose all that apply.)

- a. SWE Collegiate or Professional Member
- b. K-12 Educator Member
- c. Parent/Guardian of SWENext Member
- d. SWENext Club Advisor
- e. Other _____
- f. Not Affiliated

10. With what races or ethnicities do you most identify? (Choose all that apply.)

- a. White or European American
- b. Hispanic, Latino, or Spanish
- c. Black or African-American
- d. Asian American
- e. Native Hawaiian or Pacific Islander
- f. Native American or Alaskan Native
- g. Other: _____
- h. Prefer not to answer

11. During the EXPO, how many DIFFERENT trading cards did you collect?

- a. None
- b. 1-5
- c. 6-10
- d. > 10

12. During the EXPO, which was your favorite booth or demonstration? Leave blank if you did not view any demonstrations or did not have a favorite.

13. Are you an engineer or do you have an engineering degree? a. Yes b. No

14. What did you learn today that you did not know before today's event?

Thanks very much for your help!
Please hand in your completed survey. Stay in touch with SWE at www.swe.org.

Invent It. Build It. – EXPO Exhibitor Feedback Form
Thank you for your participation. Please take a few minutes to fill out this survey.
 Your comments and ideas will help make this event better in the future.

1. What grade would you give **the EXPO**? Please circle the letter to show your answer.

A	B	C	D	F
----------	----------	----------	----------	----------

2. What did you like most about the EXPO? What else did you like?

3. How would you change the EXPO for the future?

4. Please tell us how much you agree with the following statements about today’s event. Please check the box to show your answer.

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree	Not Applicable
Exhibitor registration went smoothly.						
The fee for exhibitor registration was reasonable.						
The on-site check in process was helpful to us.						
The set-up and tear-down of the booth went smoothly.						
We would be interested in exhibiting at other SWE Conferences, local or national.						
SWE’s IIBI EXPO compares favorably with others where we have exhibited.						
Our booth received enough interest and foot traffic.						
We enjoyed the fact that this was an event for girls.						
We enjoyed interacting with the adults and children who visited our booth.						

Thank you very much for your help!