African-American Girls
IMAGINE ENGINEERING

www.girlscouts.org/engineering

What’s in your future?
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What Do Engineers Do?

Engineers are creative problem-solvers who aim to improve the world, increase productivity, and help people live better lives. They apply math and science principles to design everything from 3-D televisions to bionic body parts to hybrid cars. Just imagine how many engineers worked to improve airplanes so that they can carry up to 800 people—or, how many engineers created the Kingda Ka roller coaster that travels at 128 miles per hour! Engineers not only work on exciting projects, but are also part of a growing field with above-average salaries.

Imagine Engineering gives you an overview of some of the common types of engineers and their job duties—but this is just the beginning. You’ll also find profiles of women engineers, tips and advice, and Web sites where you can learn more.

As an engineer, you might:
- Develop the world’s fastest jets
- Design solar-powered medical equipment
- Invent a new generation of e-readers
- Power the quickest escalator using minimal electricity
- Design underwater recycling systems
- Make power tools operate more efficiently
Aeronautical Engineering

Aeronautical engineers design airplanes, satellites, and rockets. Because of the field’s complexity, they usually specialize in one area, such as designing an aircraft’s structural or electronic components. When aeronautical engineers design an airplane, they use their engineering knowledge to ensure its safety. They must also study the consumer market to learn what people want, and then try to include these new features in the design. (Starting salary: $58,130)

Can you imagine yourself:

☐ Yes  ☐ No  Working with a team to send astronauts into space?
☐ Yes  ☐ No  Designing a commercial airplane?
☐ Yes  ☐ No  Developing materials that can withstand high temperatures as they enter and exit the atmosphere?

Want to know more?
A biomedical engineer designed triathlete Sarah Reinertsen’s prosthetic leg. Read more about Reinertsen, a former Girl Scout, at www.alwaystri.com.

Biomedical Engineers use their skills to design medical equipment and, ultimately, improve people’s health. As a biomedical engineer, you might develop medical devices like pacemakers for people with heart problems, or you might design creative ways to get medicine into a person’s body. (Starting salary: $47,640)

**Can you imagine yourself:**

- **Yes**  **No**  Creating ways to generate new eye tissue that enables a blind person to see?
- **Yes**  **No**  Developing new ways to deliver medicine, like the continuous insulin pump for diabetics?
- **Yes**  **No**  Designing and improving artificial limbs?

**Want to know more?**
Read more about biomedical engineering at www.dmoz.org/Science/Technology/Biomedical_Engineering.
Civil Engineering

Civil engineers help build public buildings and transportation systems, tunnels, bridges, water systems, and dams. As the United States continues to add and rebuild transportation systems and structures, the Department of Labor predicts that the number of civil engineers will increase. If you’re looking for a career that offers a good chance of getting a job, think of this! (Starting salary: $59,000)

Can you imagine yourself:

☐ Yes  ☐ No  Helping build a suspension design like San Francisco’s Golden Gate?
☐ Yes  ☐ No  Creating effective mass-transportation systems?
☐ Yes  ☐ No  Helping design skyscrapers?

Want to know more?
Check out the Building Big Web site to try the interactive labs and the challenges of building big at www.pbs.org/wgbh/buildingbig.
Electrical/computer engineers work on projects that improve electrical systems in homes, businesses, and public institutions. They also design electronic components in tools, computers, cell phones, and satellites. And that’s not all—some also design, build, and improve computer hardware and software. (Starting salary: $60,125)

Can you imagine yourself:

☐ Yes  ☐ No  Designing a circuit board for the next generation of cell phones?

☐ Yes  ☐ No  Designing a satellite that could warn people about a life-threatening storm?

☐ Yes  ☐ No  Designing industrial robotics equipment?

Want to know more?
Check out www.engineering.com to learn about computer coding and potential careers in computer engineering.
Environmental Engineering

Environmental engineers use science and engineering skills to improve the environment. As an environmental engineer, you might measure pollutants and plan ways to reduce the source of pollution, or you might help to ensure that dangerous chemicals don’t poison drinking water. (Starting salary: $45,310)

Can you imagine yourself:

☐ Yes  ☐ No  Developing better ways to recycle plastic bottles?
☐ Yes  ☐ No  Designing ways to supply towns with clean water?
☐ Yes  ☐ No  Improving waste-removal processes?

Want to know more?
Learn about air-quality issues, decide what you can do about it, and then make a change in your community’s environment—just like an environmental engineer. Use the Girl Scout Cadette journey book Breathe from the It’s Your Planet—Love It! series to earn leadership awards. Visit www.girlscoutshop.com for info.
This oil protection boom was built at Dauphin Island, Alabama, to shield against the BP Deep Water Horizon oil spill in 2010.

Industrial Engineering

Industrial engineering combines traditional engineering skills with business savvy, working toward two main goals: 1) create high-quality products and services, and 2) obtain the highest level of productivity from people, the equipment they work with, and processes by which they do their work. Although most industrial engineers used to work in manufacturing—from cars to furniture to cool electronics—many now focus on the healthcare, banking, airline, entertainment, and retail industries. (Starting salary: $58,358)

Can you imagine yourself:

☐ Yes  ☐ No  Studying and improving the flow of patients within a hospital, as they are admitted, tested, treated, and discharged?

☐ Yes  ☐ No  Working with relief agencies to design the safest and most efficient processes to clean up after a natural disaster?

☐ Yes  ☐ No  Improving the way people interact with ATMs so that neither customers nor teller machines ever make a mistake?

Want to know more?
Check out this video (www.iienet2.org/media/disney/flowplayer.htm) from Disney Industrial Engineering and find out how 60 industrial engineers spend their days improving quality and productivity at Walt Disney World.
Have you used an MP3 player, microwave, or bicycle today? If so, you benefited from the work of a mechanical engineer. As problem-solvers who design the physical hardware of the items you use every day, some mechanical engineers also specialize in the packaging of those items. The majority of mechanical engineers work in manufacturing—mostly in machinery, transportation equipment, computer and electronic products, and fabricated metal products. (Starting salary: $58,766)

**Can you imagine yourself:**

- **Yes**  **No**  Designing the next generation of pollution-free cars?
- **Yes**  **No**  Creating nanotechnology such as miniature medical devices that repair the human body?
- **Yes**  **No**  Designing machines that produce recyclable products?

**Want to know more?**
Visit the American Society of Mechanical Engineers site at www.asme.org. Also, join the FIRST LEGO League to learn about robotics and programming, and explore engineering with LEGO Mindstorms. Start by finding out whether your school or community has a robotics club. This Web site provides an international list of community robotics clubs: www.roborealm.com/clubs/list.php.
What were you interested in when you were a teen?
I always dreamed of traveling, going to the college of my choice, getting an engineering or accounting degree, and buying a candy-apple red sports car for me and a Volvo for my mom. I also dreamed of having a large home and a family.

What influenced your career choice and made it possible to succeed in school?
I was involved in lots of school activities, like tennis, band, and the honor society, and, in college, I pledged a female club called the Cavalettes, which promoted sisterhood. In 12th grade, I made a decision to give up being a majorette in the band to participate in a special vocational education program that allowed me to work a half day for the Veterans Administration regional office.

How did you decide to become an engineer?
From an early age, I knew that I wanted to build and design cars, and, later, I discovered the other things mechanical engineers do. In college, I did two internships that helped me decide that engineering was the right career for me. I worked at a power plant, and it was an incredible experience and opportunity.
Have you had to overcome any cultural barriers to become an engineer?
I don’t believe you ever really overcome cultural barriers as long as there is ignorance in this world. How I cope with cultural barriers is by believing in myself and my capabilities. I never give a man or woman the power to tell me who I am and what my limits are—those are determined by me. I also believe that I have a choice every day about the attitude I embrace. I am convinced that life is 10 percent what happens to me and 90 percent how I react to it.

Truly the only barrier in a person’s way is himself or herself. I must admit there are times when I believe I was not treated fairly. But I can truly say I did not and will not ever let that stop me from being the best person I can be and doing the best job I can, so that when I am gone or when someone speaks of me, they will always have something pleasant to say.

Your Turn!
What do you think? Answer these reflection questions.

What do you think helped Vicki succeed?

What do you think is Vicki’s most inspiring advice?
Q&A with Debra Coleman

This electrical engineer was so into engineering that she earned two master’s degrees

When you were a teen, what were you interested in?
I loved to read, write, draw, and sing, and I also liked playing softball.

What is your job like?
As an electrical engineer for Boeing, I work on the galleys of an airplane that are used to provide food and beverage services to passengers. The galleys have microwave ovens, steam ovens, and espresso makers—I make sure all the requirements for electrical wiring are correct so that everything operates safely.

Did anyone influence you to succeed?
My mother was the biggest influence on my success in school. She wasn’t college-educated and didn’t have much of a formal education, but she made sure that I took the best classes and got involved in after-school activities, which helped me to get into college. Also, my high-school counselor helped me get into college; although, when I applied to college, at first, I shied away from engineering programs, because I thought they were nerdy. My counselor convinced me to give it a try, because I had good grades, and she said I could always switch majors if I didn’t like engineering. Luckily, I liked engineering so much that I went on to graduate school. I have a bachelor’s degree in electrical engineering from Boston University, and two master’s degrees—one in computer information systems and another in electrical engineering.

Can you describe some experiences that influenced your career choice and helped you succeed in school?
I started school early and was in the gifted program. I grew up in Sacramento, California, which seemed like a small
town in the 1970s—we went to school during the week and church on Sundays. The small-town atmosphere helped, because there weren’t many distractions. At home, we had a set of the encyclopedias, and I did all the activities.

In high school, I joined MESA (Mathematics Engineering Science Achievement), which encourages and supports students in math and science. Through MESA, I got to do competitions and travel a little bit—I won $25, which was a lot of money to me at the time.

**Have you had to overcome any cultural barriers to becoming an engineer?**

One of the things that helped me to overcome cultural barriers was being in an academically focused school. In elementary school, I transferred to a different school and, from an early age, was in academic-success mode. It is very important to get kids into this type of environment, so that they won’t be uncomfortable.

**Your Turn!**

What do you think? Answer these reflection questions.

What do you think helped Debra succeed?

What do you think is Debra’s most inspiring advice?
We asked engineers from different fields about the advice they would give to African-American girls interested in engineering. Here’s what they told us:

- Seek out opportunities to meet female engineers and learn about their jobs. Ask if you can tour a business that has engineers.
- Find a mentor to help you succeed in school and learn about math and science. Family members, school counselors, and Girl Scout volunteers are good mentors.
- Think about what you want in the future and then work toward that. Nothing comes easy. You can be cool and still get your homework done.
- Stick with sciences and math—these subjects are the passport to doing whatever you want in engineering.
- Focus not only on developing top-notch math and science skills but also excellent writing and speaking abilities.
- Don’t give up on education. The more knowledge you have, the more powerful you are—no matter what you want to be in life.
- Know the history of black engineers and scientists. When you know your history, you are able to build on it. Did you know that African Americans invented the filament in a light bulb and the Super Soaker?
- Listen to and observe older people, so that you don’t have to learn everything the hard way.

Your Turn!

Circle your favorite piece of advice. Why did you choose this one?
Help Your Daughter Succeed in School

We asked engineers from various fields to share their best advice for parents/guardians of African-American girls. Here are their tips:

How To Help Outside the Classroom
• Tell your daughter that you believe in her and that it’s possible for her to become an engineer. Your message is more important than any other message she will hear.
• Learn about educational opportunities available for your daughter.
• Seek out opportunities in which your daughter can interact with African-American professionals.
• Rest assured that your daughter can become an engineer and still be close to her family and community.
• Watch TV shows together that encourage learning about math and science, like SciGirls and Design Squad on PBS.
• Create opportunities to do science and math at home, such as encouraging your daughter to take things apart to see how they work. Ask questions to get her thinking about how things work, such as, “How do you get a song to play on an MP3 player?”
• Encourage your daughter to take math and science classes in high school.
• Encourage your daughter to get involved in after-school activities to learn new things.
• Tour colleges with well-regarded engineering programs.

How to Get Involved with Your Daughter’s School
• You can communicate with your daughter’s teachers and school counselors whenever necessary. Teachers usually are available before and after school for phone calls and meetings and tend to be good about answering e-mails. If possible, introduce yourself to teachers at the beginning of the year.
• If your daughter is placed in a class that was not requested or is below her level, speak up right away. Don’t wait—changes to schedules must be made early in the semester, usually the first week of school.
• Get involved in the school and community by attending events such as open houses and family nights.
• Set up a meeting with your daughter’s school counselor before her senior year. Counselors have information on financial aid, scholarships, and how to apply to college.
Get Ready for an Engineering Career

Engineers possess high-level skills, earn high wages, and have many options when deciding on a career field. Experts predict a strong demand for engineers in the future, especially for women. You can see the contribution of women engineers in products like the graphing calculator, alternative fuel for cars, and processes for the large-scale distribution of antibiotics.

Not sure how to prepare for an engineering career? Here are some suggestions from engineers:

**During Middle School**
- Learn how to work as a team by getting involved in clubs and sports teams.
- Get the best grades you can. Seek out help from tutors or teachers if you don’t understand an assignment.
- Join Girl Scouts, which hosts events and camps to help you learn more about science, math, engineering, and technology. Join an all-girl robotics team and learn to build and program a LEGO robot.
- Attend day camps or afterschool clubs related to science and math.

**During High School**
- To help you prepare for college, take four years of math (including calculus, if your school offers it) and science (including chemistry and physics). Take computer programming, if your school offers it.
- Meet with your school counselor and ask about ways to prepare for an engineering career.
- Attend Girl Scout events. As a Girl Scout Senior and Ambassador, you could have opportunities to job-shadow an engineer.
- Tour colleges with strong engineering programs.
- Apply for college and financial aid.
- Research engineering careers on the Internet.

**During College**
- Talk to your advisor during your freshman year to help you plan a program of study.
- Map out your four years to ensure you get the right classes.
- Join or form study groups to help with math and science classes. Even the best students benefit from these groups.
- Seek internships or co-op opportunities in engineering.
- Continue to seek out mentors.
- Join your college chapter of the Society of Women Engineers (www.swe.org) and other engineering organizations.
What did you do today?

Girl Scouting offers so many leadership-building opportunities for middle- and high-school girls, from international travel to adventure sports to take-action projects that aim to make the world a better place, at home and afar. In Girl Scouts, girls choose activities that match their interests and aspirations, all while enjoying a national leadership experience that builds skills and strengthens sense of self.

In Girl Scouts, you can climb mountains and swim rivers, and you can also:

- Design new products, just like an engineer.
- Visit a cutting-edge design-and-tech institute.
- Design an alternative energy system.
- Conduct energy audits of buildings you use every day.
- Explore how green technology is at the forefront of astronomy, environmental science, and robotics.

Software design? Storytelling? Saving the planet? All part of being a Girl Scout!

Girl Scouts invites girls on a journey of exciting challenges, real-life stories, and creative projects that help them become leaders. While exploring a vast world of experiences—such as travel, camping, and connecting online—girls work with members of their community and each other to make the world a better place. Interested? Check out journeys, a series of Girl Scout books, at www.girlscoutshop.com.

How to Join Girl Scouts
Visit www.girlscouts.org/join to find out how to join Girl Scouts, or call (800) 478-7248 for more information.
Want to Know More?
Check out these Web sites

Engineer Girl (www.engineergirl.org)
Explore careers in engineering, read stories of women who work in the field, and get advice on the best high-school classes that will prepare you for college.

BrainCake (www.braincake.org)
Read profiles of female engineers and join a network of girls ages 11–17 interested in learning more about science, technology, engineering, and math.

SciGirls (pbskids.org/scigirls)
SciGirls is a groundbreaking TV show and interactive Web site that may transform how you look at science, technology, engineering, and math. Watch the shows on TV and use the Web site to explore real-world science and math problems and learn about careers in science, technology, engineering, and math.

Design Squad (pbskids.org/designsquad/season3/index.html)
Watch videos of students competing to solve problems, such as figuring out how to build the fastest sailboat. Select “Make Cool Projects,” and you will find fun projects, like how to build a hidden alarm or your own dance-mania pad.

Discover Engineering (www.discoverengineering.org)
Ever thought about the biomechanics of skateboarding? How about solar cooking? Learn about these engineering projects and others in the “Video Activities” section.

Engineer Your Life, a Guide to Engineering for High School Girls (www.engineeryourlife.org)
This guide to engineering for high-school girls features loads of videos of female engineers working on world-changing projects.

Connect with Professionals

National Society of Black Engineers (www.nsbe.org)
The National Society of Black Engineers (NSBE) strives to stimulate and develop student interest in engineering with the ultimate goal of increasing the number of students of color studying engineering. NSBE has more than 30,000 members and 233 chapters on college and university campuses. Use this Web site to search for scholarships and special events in engineering.

Thurgood Marshall College Fund (www.thurgoodmarshallfund.net)
The Thurgood Marshall College Fund provides leadership development, scholarships, and other resources to public historically black colleges and students.

White House Initiative on Historically Black Colleges and Universities (www2.ed.gov/about/inits/list/whhbcu/edlite-list.html)
Black colleges and universities offer various kinds of support to help all minorities’ success in higher education. At this site, you will find a map of the historically black universities and colleges, links to scholarships, and information on the White House initiative that offers support to the colleges.

Society of Women Engineers (www.swe.org)
Learn more about engineering, apply for scholarships, and find out how to connect with women engineers on the SWE site. The organization also offers scholarships to college students.
3-2-1: What Steps Can You Take?

Directions: Use the information and resources in this handbook as you begin to explore the incredible world of engineering. Complete the 3–2–1 with your parent/guardian.

3 What three things about engineering interest you?

2 What two types of engineering would you like to learn more about?

1 What is the one first step you will take to discover more about engineering?