

ILLUSTRATIONS BY CHRIS SABATINO

Three Cheers to Engineers!

Did you flip a light switch this morning? Put on your bathing suit, rayon shorts and rubber flip-flops? Catch a lift to the pool in your mother's minivan? Sip a soda? If so, you've come in contact with...engineering. Huh? What's engineering? It's using technology to solve a problem.

Need to get from your house to your BFF's? Civil engineers designed the roads and bridges to get you there. Automotive engineers designed the SUV your mom chauffeurs you around in. Aerospace engineers get us to the stars and the moon, and geological engineers help find the fuel for all these trips.

Downing lots of soda this summer? Textile engineers take your empty plastic soda bottles and recycle them into technical fleece—like that cozy pullover that'll keep you warm this winter. Does your heart skip a beat? If it's not love, you might need a pacemaker, created not by a doctor but by an

electrical engineer. Bored? Software engineers design the games you play on your computer. They also create the programs that make those cool special effects you saw in your favorite action flicks this summer. Is your computer too slow? Computer engineers are working diligently on the next generation of faster and more complex chips.

And don't forget chemical, mechanical and industrial engineers. Chemical engineers use new chemicals to solve problems. And anything that has moving parts—from staplers to jet engines—has been touched by a mechanical engineer. They design levers, switches and other parts to function in a safe, reliable, effective way. And industrial engineers design the machines and procedures that manufacture all the cool stuff you already own—or would like to! So see?

Just about everything has an engineering aspect to it!

by **Patricia J. Paddock**

What Makes Up the



RESEARCH Engineers find out what has worked in the past, what isn't working now and try to figure out why. This might mean doing experiments in a lab or on a computer, creating models, or reading reports. Do you like to get to the root of a problem? Doing the research for school projects? Taking your bike apart to see how it works? Hmm. could be the field for you!

DEVELOPMENT Engineers come up with new products, new processes or more efficient ways of doing things. Are you creative? Imaginative? Can you often see more than one solution to a problem? This could be your bag!

DESIGN Once the new item or procedure is developed, engineers have to fine-tune it. That means making models or simulations, field testing, and refining it. Can you visualize things easily? Do you like to sketch? Love to tweak and fiddle with things until

they're just so? Hey, you may be a budding designer.

CONSTRUCTION/PRODUCTION This is the "mass-production" phase. New stuff is created in mass quantities, so everybody who wants it can get it. Sometimes, the item is fussed with a tad more. Are you great with details? Do you like to see things take shape? Are you precise? This might be your thing.

SALES You need to get the word out about new things. And people can often use some help understanding why they need a new product or system and how they would benefit from it. Are you persuasive? A great communicator? You could be a natural salesperson.

MANAGEMENT Each of the above stages needs an overseer. If you have rockin' organizational, communication and leadership skills, this might be the gig for you!



IS ENGINEERING FOR YOU?

Take this quiz and find out. Answer the following questions with a "yes" or "no."

1. Do you consider yourself an inventor?
2. Do you want to make the world a better place to live?
3. Are you good with nitty-gritty details?
4. Do you have a major imagination?
5. Do you like being a problem solver?
6. Do you enjoy group projects?
7. Are you totally into drawing, sketching or building things?
8. Do you like to show people how things work?
9. Did you get good grades in science or math last year?
10. Are your writing skills pretty good?

If you answered "yes" to five or more questions, you might have what it takes to be an engineer! If not, don't sweat it. Read on to learn about professional engineers. Maybe some of their work will spark your interest.



ENGINEERS TO THE RESCUE: Did you see Apollo 13? Remember that scene when the space capsule was losing air and everyone feared the astronauts would die in space? The engineers closed themselves into a conference room with all the supplies available to the astronauts. The clock was ticking because the engineers only had a short time to figure out how to get more oxygen to the astronauts. It took almost all the time they had, but the engineers did it—they found a way to save the astronauts! Now here's a problem for you to solve. OK, it may seem unimportant compared to near-dying astronauts, but some plants are at stake!

THE PROBLEM: Your neighbor has paid you in advance to look after her house-full of plants—while she's on vacation. Now you've found out you're going to be gone for a week yourself, visiting your grandparents. How can you keep your commitment—and the money—while sitting on the beach at Grandma's?

Engineering Process



What you need

- 2-pint plastic container with lid
- Potted plant (start with a 6- to 8-inch diameter plant)
- Scissors
- Pen with a point
- Cotton string
- Newspaper
- Water

How to have plants water themselves:

1. Using the pen, poke a hole in the middle of the plastic container lid so the string can go through easily.
2. Fill the container with water, and soak about 18 inches of string in it.
3. Gently remove the plant from its pot, and set aside.
4. Coil the string in loops on the bottom of the empty plant pot. Run one end of the string through a hole in the middle of the pot's bottom so that it hangs down at least 8 inches.
5. Thread the hanging string through the top of the plastic lid, making sure the string does not lie on top of the lid. Fit the lid back onto the container. The string will eventually drop to the bottom.
6. Place your plant back into the pot, which should be resting on the lid. If the soil around the plant is not moist, water it from the top once, just enough to dampen it.

To find out why this works, go to <http://www.girlscouts.org/girls/Why/sciact/water/makeyour.htm>
Imagine that!

Some engineers get paid to dream up cool new rides at amusement parks! But before you can improve on something, you have to know how it works. Know why people don't fall out when the roller coaster goes through the loop-de-loop? It's something called centrifugal force. Basically, people are traveling so fast that this force pushes in so hard from outside the car, that people stay in their seats (of course, the restraining bar and other pieces of safety equipment help, too!). Still hard to understand? Try the following experiment.



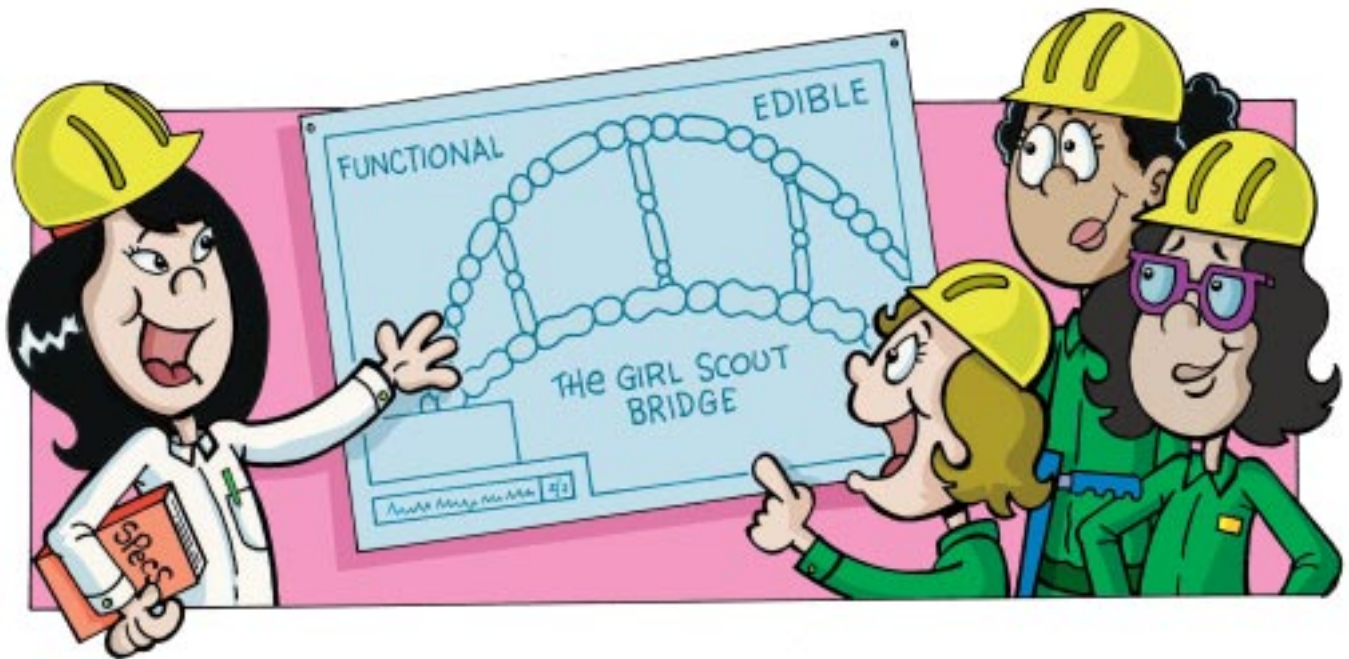
What you need

- Old clothes/swimsuit
- Bucket with a handle
- Water
- Lots of space, outside, where you won't hit anyone or anything!
- Warm weather, so you won't get cold, if you get wet

How it works

Fill bucket halfway with water. Hold handle and swing in a big circle—like a ferris wheel—as hard and as fast as you can, turning bucket upside down at some point. If the bucket is moving fast enough, you'll stay dry. As you slow your swing, the force outside the bucket isn't strong enough to keep the water in. And you'll get soaked! What determines this? The speed of your swing, the size of your arc and the amount of water you use.





All in a Day's Work

Maria Grazia Bruschi is a civil engineer who specializes in the design and inspection of bridges. Maria explains, "My job involves designing bridges, deciding what type of bridge to use in a new location, and then calculating the size of its girders [beams], piers [the columns that hold them up] and other parts. We prepare a set of drawings showing all the parts of the bridge, in a book called Specifications, that explains how to build each part and what materials to use. The drawings and specifications are then used by contractors to build the bridge."

Much of the work bridge engineers do involves fixing problems on existing bridges. Some are in bad shape because they haven't been painted in years.

"If the steel girders have rusted and cannot support the traffic, we need to reinforce them by adding more beams," Maria says. "Sometimes, we just need to replace the whole bridge. Other bridges are in good shape, but need to be widened for increased traffic. We then add girders and new piers on the sides."

All bridges need to be inspected every two years to make sure they are safe for traffic and will not fall down. "When we do a bridge inspection, we climb all over the bridge, or we use lifts and other machines to get a closer look at all the parts of the bridge," Maria continues. "We take very detailed notes and lots of pictures of all the problems. Then we write a report detailing the problems and our recommendations for fixing them." Can you picture yourself wearing Maria's hardhat?

What Can You Do Now?

- ◆ Take as many math and science courses as you can.
- ◆ Gain experience with computers-the hardware and the software.
- ◆ Check out the Girl Scout's Just For Girls Web site at

www.girlscouts.org/girls

And Girls' Life's site at www.girlslife.com.

- ◆ Don't neglect your English and social studies classes. Engineers must explain to clients how they've solved problems, and they need to know about the problems in the world that could be solved with a bit of engineering know-how.
- ◆ Get involved in some extracurricular activities-you'll gain organizational and teamwork experience! For more information on women in engineering careers, check out these on-line resources:

- The Women of NASA: quest.arc.nasa.gov/women/intro.html
- The Society of Women Engineers: <http://www.swe.org/>
- The American Society of Mechanical Engineers: www.asme.org/careers
- Girl Scouts' Just for Girls Website: www.girlscouts.org/girls/How/Careers/Bridge/shoe.htm#JustforFun

Program Links

If you've enjoyed the activities on these pages or would like to try your hand at more engineering projects, try any one of the following.

Girl Scout Badges and Signs:

- Science in Action
- Science in the World
- Water Wonders
- Do-It-Yourself
- Aerospace
- Architecture
- Car Care
- Computer Fun
- Creative Solutions
- Food, Fibers and Farming
- Geology
- Making Hobbies
- Textiles and Fibers

Interest Projects for Cadette and Senior Girl Scouts:

- Build a Better Future
- Why in the World?
- Architecture and Environmental Design
- Car Sense Computers in Everyday Life
- Home Improvements
- Math, Maps and More
- Outdoor Survival
- Space Exploration
- Smooth Sailing
- Textile Arts