# ENGINEERING—

College Days provide an opportunity for prospective engineering students to showcase their design skills, compete for scholarships, and see how they might fit into the program at Walla Walla College. Professor Louie Yaw looks on as a prospective student builds a bridge that will be tested for strength. Inset: Tyler Duffy's award-winning project (WWC: BSE-ME/BBA-Acct '04), a heli-portable drilling machine, has now been manufactured multiple times and is part of a growing business, Excel Drilling.

# A Service-Oriented Profession

## Preparing Your Students for Engineering Careers

BY MARLENE A. BAERG

**Engineering is subdivided into numerous areas of expertise.**

Engineers turn ideas into reality! Nearly everything that makes the economy operate, that makes your life easier and more fun, has been created by engineers. Engineers designed mechanisms that allow you to have running water in your house, electricity to study your Bible at night, and the Internet in order to learn about and keep in touch with others. Engineers have even provided the means to give Bible studies to people in countries where Bibles are burned.

What better way to witness in the workplace than help one's fellow human beings? Indeed, engineering is a service-oriented profession!

### Types of Engineers

Engineering is subdivided into numerous areas of expertise. The most popular at the undergraduate level are: mechanical, civil, electrical, and computer engineering, as well as bioengineering, all of which are taught in Seventh-day Adventist colleges.

*Mechanical engineers* designed the car you drive, as well as the heating and air-conditioning systems that keep your office and home warm in winter and cool in summer. They also work on designs and improvements for race cars, rockets, airplanes, combines and tractors, roller coasters, turbines, and construction equipment.

*Civil engineers* design skyscrapers, schools, and other buildings; aircraft, water systems, bridges, dams, airports, highways, tunnels, water treatment plants, pipelines, and irrigation projects.

*Electrical engineers* work in areas such as new computer technologies and hydroelectric plants. They also design laboratory instruments, motor controls, power systems, computer chips, satellites, TVs, VCRs, computer systems, cell phones, PDAs, audio controls, and various types of communications equipment.

A new area is Computer Engineering (CompE). Computer engineers make it possible for people around the world to study the Bible online in more than 44 languages. In contrast with a computer programmer, who is given specifications to create a code that runs a program, the computer engineer ensures that the networking components and data work together. Computer engineers also design hardware and software for data storage, video processing, computer graphics, PDAs, speech processing, networks, databases, computer processing, embedded systems, and integrated circuits.

Bioengineers apply advanced technologies to both living systems and specialized instruments. They design and develop medical equipment such as minimally invasive surgical tools, miniature blood-testing instruments, artificial joints, implants, and prosthetic devices, as well as bio-reactors to produce new substances. They also work to improve imaging technology, study how to improve crops and make vehicles and offices more user-friendly, and research ways to stimulate the muscles of paralyzed people. Many of them take advanced training in medicine, dentistry, physiology, or public health.

Through the years, engineers have done great things for society and the church. Some examples of those who graduated from an Adventist school of engineering (Walla Walla College in College Place, Washington) are noted in Sidebar 1, below.

### Do You Have Budding Engineers in Your Class?

Most students who choose engineering as a career are born with the ability to figure things out and have an innate curiosity about the way things work. Some schools include engineering as a part of the grade school curriculum. If you do not do so at your school, here are some ways to identify budding engineers and encourage them:

***Most students who choose engineering as a career are born with the ability to figure things out and have an innate curiosity about the way things work.***

Do you have students who do well in mathematics? This is your first clue. Many of these students like to take things apart and put them back together. Studies show that by the 6th grade, students begin to make choices about careers. Therefore, schools should provide information starting at the early elementary level. Incorporating information about engineering into the math and science classroom will encourage students to explore their natural affinity in this area.

Engineering Week (also known as E-week)—the week of George Washington's birthday in February (he was an engineer before becoming the first president of the United States)—is an excellent time to introduce engineering concepts at any grade level. Many colleges and universities offer a plethora of activities during this week. Each year during

SIDEBAR 1

## Personal Stories/Examples

**Mechanical Engineering**

Steve Speyer (ME '88) started at Boeing Aircraft, dealing with galleys of planes and later moved into the school building business, where he is now managing $250 million projects. Sukhdev Mathaudhu (ME '70) has won many awards for energy-efficient building designs.

**Civil Engineering**

Gary Curtis (CE '59) was part of the design team of the Seattle Space Needle (Washington State), the structural engineer of record for the geodesic dome over the Spruce Goose, as well as other bridges including the new "roller coaster bridge" in Long Beach, California. Mark Schwisow (CE '94) now works in Cambodia as ADRA country director.

**Electrical Engineering**

Harley Henrich (EE '79), who scored in the top 10 percent in his qualifying exams for the Ph.D. program at Stanford University, has created several items that major companies use routinely in their semiconductor businesses. His work has included radio frequency identification. This technology uses a wireless radio transmitter to power extremely inexpensive electronic labels (RFID tags). Wal-Mart plans to use RFID tags for all products they sell. CNN's 2005 list of the top 25 innovations in the past 25 years has named RFID as No. 10 (http://www.cnn.com/2005/TECH/01/03cnn25.top25.innovations).

As part of the Sow One Billion Campaign (http://www.hopetalk.org), www.BibleInfo.com's Andrew DePaula (EE '96) has been instrumental in providing tools to study the Bible in a variety of languages (16 to date, two coming online shortly).

**Computer Engineering**

Robert Triebwasser (CompE '00) is working at Level Two, Inc., in Bellevue, Washington, designing fault tolerant systems for public safety and police use. Ted Kramer (CompE '03) is now working at the Space & Naval Warfare Systems Center in San Diego, California, where he writes software for robotic vehicles, ground surveillance radars, and unattended ground sensors.

**Bioengineering**

Andrew Cupino (BioE '03) is studying at Jefferson Medical College in Philadelphia where he is considering neurology and/or a graduate degree in electrical engineering, math, or physics to assist with research in this field. The engineering portion of his undergraduate education was very helpful in his study of the neurons and the cardiovascular system. Heidi Hutchins (BioE '02) is studying to become a physicians assistant, while Brandon (BioE '01) and Malinda (BioE '02) Kearby are attending dental school.

A student in the WWC Robotics and Manufacturing Lab builds a manufacturing system.

In the UNIX computer lab at WWC, students learn how to design in three dimensions using high-end software similar to that used in industry.

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E-week, Walla Walla College holds an Egg Drop in which many local elementary and high school students participate. The objective of the competition is to create packaging that will protect a raw egg during a launch from the top of a three-story building on campus, aiming at a cast-iron skillet on the ground below. In 2004, the event once again made the front page of the local newspaper, with a photo of the winning entry in the "lightest materials" category.

Many Internet sites[1] offer a variety of resources, including activities that require minimal supplies and equipment. Other ideas include competitions[2] in which you can encourage your students to participate, or activities in your local area that show how engineering is a critical component of society.

The Adventist Lego League[3] is a new hands-on way to get your students involved with robotic Legos. Chapters are forming across the U.S. that will host challenge events. Integrating this into your curriculum can also help students explore their aptitude for engineering.[4]

A strong background in mathematics is vital to preparation for engineering careers. Although engineers do not use mathematics every day, learning to think mathematically enables them to solve a variety of problems. At the college level, engineering students will need to take at least two years of math, beginning with calculus, so a solid foundation of math at the K-12 level is very important.

Students interested in engineering

***In the past 20 years, project teamwork has gone from 21 percent to more than 50 percent of an engineer's job.***

should also take high school courses in English, science, social studies, and the humanities (see Sidebar 3). Writing is crucial for engineers, who need to be able to clearly communicate their ideas and designs. Studies in foreign languages and the practical arts are also valuable.

Other disciplines, as well, will provide background information and skills for the various industries in which the engineer chooses to work. Engineering clubs can give students an idea of what is involved in the profession, scheduling guest speakers and field trips.

In today's environment of downsizing, consolidation, efficiency, and productivity, an engineer must be able to adapt to his or her environment. Knowing the basics well and reading widely will provide a strong background for a variety of areas. Specialization at the graduate level is recommended for many jobs.

For most engineers, teamwork is a critical part of the job. In the past 20 years, project teamwork has gone from 21 percent to more than 50 percent of an engineer's job. Socialization, liberal-arts studies, and exposure to other cultures will help the engineering student understand and get along with people and make the most of the team environment. Cooperative learning projects and leadership opportunities will also help students prepare for teamwork. There are many openings for engineers in mission work (including ADRA) and other jobs in a variety of countries.

### Which College to Attend?

When your students are evaluating which school to attend, several questions are important:

1. What type of major have you chosen? Does the school offer it? Investigate a variety of careers and the preparation necessary for each, using the major/minor finders and career skills tests typically offered during the junior or senior year in religion class or by the guidance counselor at your school.

2. What is your preferred type of environment/lifestyle? What kind of friends do you want to make? Will the location of the school, class schedule, and extracurricular activities make it difficult to keep the Sabbath and to fellowship with other Adventists?

3. What type of student-teacher ratio do you want? Do you want to interact with your professors? Many of the large schools use teaching assistants to answer questions after class. Teachers rarely get to know the students.

4. Do you want a program that is highly competitive? How is the school rated? Is it accredited by the appropriate organizations?

Walla Walla College (WWC) has the only Seventh-day Adventist four-year engineering program accredited by ABET (the professional engineering accrediting body). Andrews University (Berrien Springs, Michigan) recently announced that it will offer a four-year program. In a

**Students work together in teams in the WWC Digital Electronics Design Lab to create a custom Central Processing Unit (CPU).**

SIDEBAR 2

## Walla Walla College School of Engineering Fast Facts

- Founded in 1947
- ABET-accredited engineering program
- 93 percent placement rate in either engineering employment or graduate school
- More than 1,200 graduates to date
- In 2004, 59 percent of freshman ACT math scores were at the 81st percentile or higher.
- Fundamentals of Engineering Exam, taken by all seniors, with a better pass rate (~90 percent) than the national average
- Senior project required for graduation
- Co-ops are available
- Graduates are routinely identified as having higher technical maturity and ethical understanding than their counterparts
- Students regularly compete and beat top undergraduate engineering schools (including Massachusetts Institute of Technology)

variety of competitions, WWC has fared well against the best engineering programs in the U.S. public and private sectors.

If professional certification is important for your career, you may be delayed in taking your exams if you graduate from a non-ABET accredited program, depending upon where you want to take your exams. WWC has affiliations with

***The importance of a strong background in mathematics as preparation for engineering careers cannot be overstated.***

the other Seventh-day Adventist colleges and universities in North America and the Caribbean, which offer a one-year or two-year pre-engineering curriculum. With careful planning, students who would like to study near home or attend another school with a sibling or friends for part of their college career can do so. Students who would like to be a part of a program for four years can come directly to WWC from high school.

Engineering is a rigorous program. Some students take five years to complete an undergraduate degree. If students intend to participate in competitive sports or other time-consuming extracurricular activities, they should expect to take at least five or six years to complete the

**WWC engineering students take a field trip to the nearby Stateline Wind Energy Center, the largest commercial facility of its kind in the northwest U.S., where they learn how renewable energy can benefit society.**

program and do their academic best. At a small school with a good reputation, bright students can be academically challenged by the professors who know them and can work with them individually. Struggling students can move at their own pace as they get the help and attention they need. The WWC program requires all students to take the Fundamentals of Engineering exam during their senior year. Students from WWC have a better pass rate (~90 percent) than the national average.

WWC students who choose postgraduate education are routinely accepted into the best programs in the country. What a bonus to be able to get one's undergraduate education in a Christian environment and make friends for life!

Engineering prepares students for many careers. So whatever one's personality type, with appropriate training, he or she can find a niche within engineering.

Engineering is not an easy program, but the rewards are tremendous. Engineers can derive great satisfaction from the tangible products they create and their contributions to the community. In the figure at the bottom left, any one of the small cubes could be where engineering graduates get a job. With additional training and experience, they can move vertically or horizontally.

**There are many openings for engineers in mission work (including ADRA) and in other jobs in a variety of countries.**

If you are a K-12 teacher, encourage your students to read about engineering and stimulate them to discover how things work. As students are exposed to engineering, they can make educated choices about whether this is a field in which they are interested and can excel. If you would like for your students to participate in campus or regional events, please contact the author of this article.

SIDEBAR 3

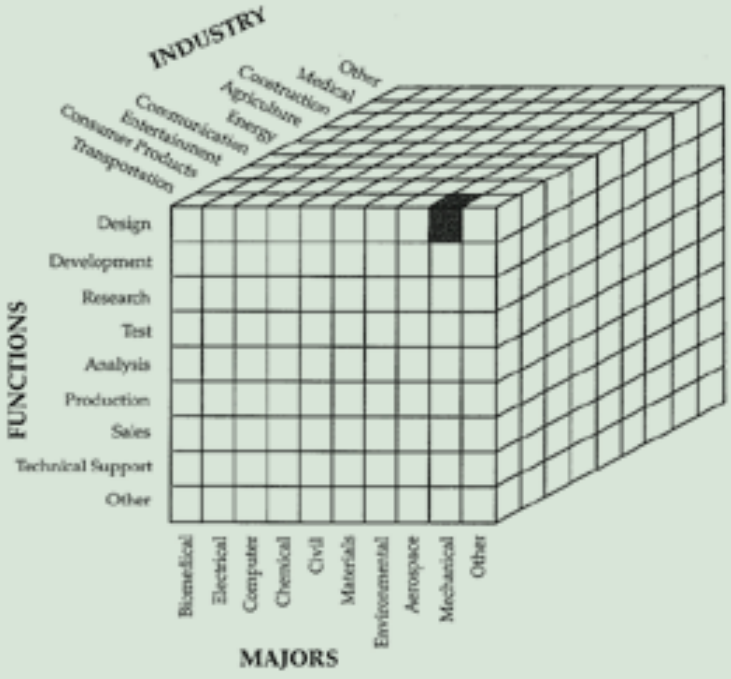
## Required Courses for Admittance

High school diploma or equivalency, including the following courses:

| Number of years | Discipline |
|---|---|
| 4 | English |
| 1 | Laboratory Science |
| 4 | Mathematics (general mathematics, plus algebra, geometry, and trigonometry) |
| 2 | History |

SIDEBAR 4

## Engineering Positions

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NOTES AND REFERENCES

1. See http://www.eweek.org, http://www.discoverengineering.org (Grades 6-9), and http://www.engineeringsights.org.
2. For example, JETS: http://www.jets.org, and Future City: http://www.futurecity.org.
3. See http://www.adventistlegoleague.net.
4. See the *Adventist Review* article at http://www.adventistreview.org/pdf/2004/1527-2004.pdf, "Adventist Lego League Hosts First NAD Robitics Challenge" (July 2004), pp. 40, 41 (See http://www.cnn.com/2005/TECH/ 01/03/cnn25.top25.innovations/.)