

THE PRE-ENGINEERING *TIMES*

A publication of JETS



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Explore...Assess...Experience Engineering

JETS provides programs and resources that help students explore, assess, and experience engineering first-hand. From exciting student competitions to assessment tools and career exploration materials, JETS helps students plan for rewarding futures by showing them how engineering can help them pursue their dreams.

EXPLORE...

Find your dream job, meet extreme engineers, watch videos

Feature Story

Fire Investigation Engineering

Fire prevention engineering combines science and technology to help protect people, property, and the environment from fires. About 3,000 people die in the United States each year due to fires. Additionally there are billions of dollars in property damage. Fire prevention engineers work in many areas from helping to develop better building codes, fire prevention systems, and sprinklers to fire safety for consumer products and items such as children's sleepwear to reduce fires and save lives.

Fire investigation is the forensic side of fire protection engineering. These professionals investigate the cause of fires. In addition to ruling out arson, they want to learn how a fire started and how it spread. They collect data to find out where fire is occurring so that fire prevention programs or technologies to focus on these specific problems can be developed. For example, because we know that cooking is the #1 source of fire within a home, it's important to educate people so they know not to put water on a grease or electrical fire. Investigating fires was traditionally the realm of the fire department. Because engineers are learning more and more about the science and physics of fire-how it burns, how it spreads, and how smoke affects people-it's now become an important field of engineering.

Sometimes fire investigation engineers recreate fires in the lab to gain a better understanding of what happened or to test theories of how a

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JETS Affiliates help increase awareness of and interest in engineering and technology-based careers to pre-college students, parents, teachers, and school counselors.

To fit your organization's needs, JETS has created several ways to become a JETS Affiliate. To learn more about how your organization can participate as a JETS Affiliate and help JETS inform and excite young people about engineering careers [click here](#).



Pass it On!

Please encourage your students and their parents to subscribe to the Pre-Engineering Times! It's not only a great resource for the classroom, but also for students and their parents as they make career choices and learn about the world of engineering.

To sign up to receive the monthly Pre-Engineering Times, please go to <http://www.jets.org/programs/newssignup.cfm>. If you wish to unsubscribe, [click here](#) and include "REMOVE" in the subject line.



particular fire developed and spread. They also use computer models to predict how a fire will develop and spread based on materials in a room and the room's size and shape. And most importantly, they are developing a body of knowledge that will help prevent fires in the future.

There have been many recent breakthroughs in the field to increase our understanding of fires. These include the development of computer models that more accurately predict how fires develop and spread, and faster smoke detectors.

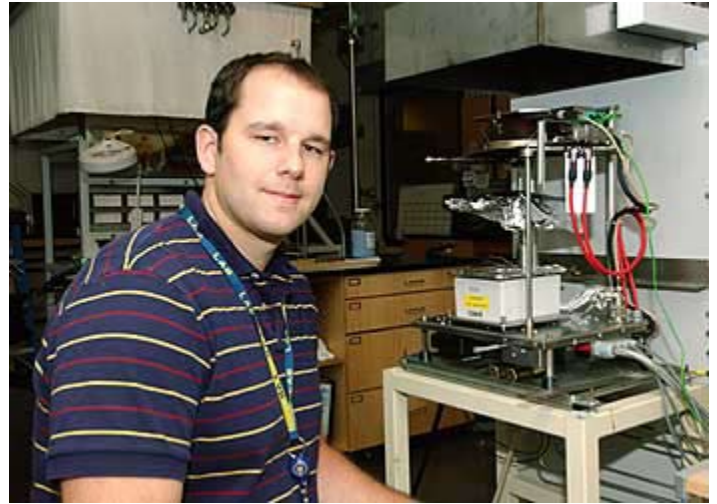
Currently, there are a handful of schools in the United States that offer degrees in fire prevention engineering or a related field. These include: the University of Maryland (bachelor's and master's degrees), Wooster Polytechnic University (master's and doctorate degrees), Oklahoma State University (engineering technical programs), University of North Carolina--Charlotte, Eastern Kentucky University, and the University of New Haven in Connecticut. Many fire prevention engineers start with bachelor's degrees in mechanical, electrical, or structural engineering before taking specialty courses or enrolling in a graduate program in fire prevention engineering.

Because there is a greater need for fire investigation engineers and fire protection engineers than there are qualified applicants, the salaries are higher for this specialty and new graduates quickly find jobs.

Most importantly, fire investigation engineers help keep people safe by passing on the knowledge they gain from investigating fires, and they make sure that arson, when it occurs, is caught and prosecuted.

Extreme Engineer of the Month

Profile: James Lord, Fire Research Engineer, Bureau of Alcohol, Tobacco, Firearms and Explosives, United States Department of Justice



Education: B.S. in Mechanical Engineering and M.S. in Fire Engineering, Wooster Polytechnic Institute

Favorite Classes: B.S. in Mechanical Engineering and M.S. in Fire Protection Engineering, Worcester Polytechnic Institute

Best Skills: Problem solving and working well as part of a team

Hobbies: Travel, skiing, and cooking. In addition to travel in the United States, Jamie's been around the world to exotic places like South Africa, Cambodia, India, and Thailand.

Role Models: Jamie's best role models were his supervisors and mentors who encouraged him early in his career and as he developed his specialty. He particularly admires their generosity in sharing the knowledge and experience they gathered over many years of work experience with the next generation of fire engineers.

Advice: Keep an open mind and look at all the types of engineering available. Because an engineering degree is a useful foundation for many different professions, considering all the options is important. Don't narrow your focus too much. Take in as much as you can over the broad spectrum of engineering.

Firefighting and Engineering

In high school Jamie decided he was interested in engineering. At about the same time he started to serve as a call firefighter and an emergency medical

technician (EMT). While most kids were going to the mall, Jamie trained to be a firefighter several nights a week and went to EMT school every weekend for a year. As an 18 year old, there was nothing more exciting for Jamie than jumping on a fire truck and running off to a call in the middle of the night. The career fire fighters on the team, however, encouraged him to go to college and get a degree.



A Great Way to Help Save Lives

Jamie chose Worcester Polytechnic Institute (WPI) because its program allows students to graduate with a Bachelor's degree in a branch of engineering in four years and get a Master's in fire protection engineering with just one additional year. And it didn't hurt that WPI had plenty of rock climbing and skiing nearby. Additionally he was attracted to WPI because he felt that having an undergraduate degree in mechanical engineering kept his options open and gave him a broader base to build his career. He has since learned that you don't really need fallback positions in fire protection engineering because there are so many different options in the field and there are more jobs than engineers to fill them. It was a tough call for Jamie though because he was also interested in the medical aspects of his EMT job, and he actively considered applying to medical school. In the end, his interest in the study of a phenomenon as complicated as fire along with his desire to help people won out and directed him into fire protection engineering.

At WPI Jamie studied mechanical engineering for his undergraduate degree. While it may seem unrelated to firefighting, Jamie says that understanding computational fluid dynamics has allowed him to specialize in the increasingly popular field of computer fire modeling. Additionally, some fire protection engineers work on designing smoke management or sprinkler systems, which draws on fluid movement and other key principles of mechanical engineering. Structural engineering, chemical engineering, and electrical engineering are other popular backgrounds for fire protection engineers.

Fire Dynamics—A Mix of Chemistry, Physics, and Engineering

Jamie's years at WPI were busy and sometimes stressful, but he loved learning all he could about fire dynamics—the theory of how a fire grows and moves through a space. It's a mix of physics, chemistry, electrical and mechanical engineering all rolled into one. One of the things that Jamie likes best about fire engineering is that there is so much to learn that you can never learn everything. "If you're interested in researching new aspects of fire engineering, the sky's the limit," he says.

Fire Protection—Beyond Codes

After graduating from WPI, Jamie was approached by several consulting firms. He chose to work for Arup, an international engineering firm with a fire engineering group known for performance-based fire protection designs. There he worked on projects involving all aspects of fire design, including using fire design to develop comparable fire protection for buildings that were so architecturally advanced that the traditional building codes didn't apply. After almost six years at Arup, during which he got to help design some really cool buildings, Jamie decided he wanted to do more research and field work and accepted a position as a fire research engineer with the U.S. Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF).

CSI in Real Life—Investigating Fires

As an ATF fire research engineer, Jamie has a widely varied set of responsibilities. He provides training to ATF certified fire investigators, conducts field investigations of fires, and does laboratory testing to support criminal cases. He also does research to better understand the way fires start and grow and how to protect against them. Here he has access to state of the art fire research tools and a laboratory large enough to build two-story houses inside the lab and burn them down to try to simulate what happened in real life.

National Response Team for Large-Scale Disasters

One of his favorite aspects of his job is his participation on the National Response Team, a group of specialized ATF investigators who join together to investigate large-scale disasters. As a fire consultant to the group of law enforcement and ATF agents, Jamie is constantly impressed with how the group can meld their specialties into the overall investigation of the event.

As Jamie describes it, the buildings they go in to investigate are usually black holes. Fire investigators pick through the rubble to figure out

where the fire started, how it moved, and the fuel and sources of air that fed it. Based on that he can assist the team by determining where the fire would have been hotter or cooler, what types of smoke to expect, how the fire may have moved throughout the space, and a variety of other fire phenomena. Supported by those types of calculations the team works to figure out how and where the fire started.



Back in the Lab—Matching Theory with Practice

After the investigation is complete, Jamie returns to the lab to test his theories about the fire with models—sometimes full-scale models—to see if his theories match with what people witnessed. All of his research is recorded and stored in the ATF database, which the bureau one day hopes to release to the academic world for further research and development of new fire protection technologies. Jamie likes his day-to-day work and knowing that something he does could someday form the basis for a new design or strategy that saves lives.

During a typical investigation Jamie might use a combination of on-scene investigations, witness statements, computer fire modeling and laboratory testing to help support a criminal case.

In a recent case Jamie used full scale testing of a large building fire to validate the results of a 3D computer fire model; the model was compared against what the witnesses saw during the fire and helped to verify the theories of the ATF fire investigators.

Tying it All Together

Jamie recommends firefighting experience for all fire engineers. He says that having seen and fought real fires helps tie it all together. With his firefighting background, Jamie is more readily able to merge the theoretical with the practical in his investigative work.

ASSESS...

Find your strengths, prepare for the future



ASSESS is a comprehensive toolkit for students in grades 9-12 who are on the path to discovering a future career in engineering. ASSESS provides guidance about engineering careers by allowing them to gauge academic preparedness in subject matter important for the profession. For more information about ASSESS, visit <http://www.jets.org/programs/assess>.

EXPERIENCE...

Get active and unlock the mysteries of engineering

TEAM+S

Behind the Scenes: Athletic Events

Registration is now open for the 30th annual National TEAMS Competition! This year high school students across the country will be challenged to go *behind the scenes* and discover the engineering involved in some of the largest athletic events, including the Olympic Games, World Series, and Super Bowl.

1932 was the first year that an Olympic Village could accommodate all the athletes, and since then villages have become a major hub of the Games. With an increasing need for security, transportation and traffic solutions, and energy efficient facilities to house all the athletes, the Olympic Village and other Olympic venues have relied on the work of engineers to solve some of the challenges that increase safety and quality of life. Additionally, with today's Games featuring 35 sports, a stark increase from the 9 events featured in the first Olympics back in 1896, there has been a drive to better an athlete's performance as competition has increased. The innovators behind these technological advancements, from the treatment of the ice along a speed skating track or luge course to the aerodynamic titanium of a golf club, have all been engineers!

TEAMS 2008 will ask students to look at these and other challenges of sporting events and as a team compile solutions to some of the issues facing event officials and engineers today, showing them the real-world applications of math and science and the important implications of engineering teamwork.

300 teams from over 130 schools from across the

country have already registered to compete in this year's competition, vying for the ultimate cash prize of \$5,000. While registration will continue through January, act now and secure your team's place at one of the 75 established host sites.

On your mark... get set... go!

[Find the host site nearest you](#) and [Register now!](#)

[View this year's challenge scenarios](#)

[Learn more about TEAMS](#)



2007-2008 National Engineering Design Challenge

High School Students Making a Difference!
www.jets.org/nedc

Congratulations to the 100 Round I Winning Teams!

One-hundred teams from seventy schools were selected by the NEDC Design Review Board to advance to Round II. JETS received over 260 Round I applications from more than 140 schools in 36 states, districts and territories. [Click here](#) to see a complete list of the winners.

Now it's time to start building!

The deadline to submit the Round II report is **Monday, December 17th by 8pm EST**. Teams will Complete Additional Research, Finalize Device Design, Construct a Prototype Device, Test the Device and submit a final report.

**Mark your Calendars for the National Finals:
Friday, February 15, 2008**

[The Westin Arlington Gateway](#)

801 North Glebe Road • Arlington, Virginia 22203 •
United States •
Phone: (703) 717-6200

Want more information? [Download the 2007-2008 NEDC Handbook](#)

What is the NEDC?

Teams of students will design an Assistive Technology (AT) device to help a person with a disability to perform or increase productivity in his or her job. Students will choose a scenario from two options and work with a person with a disability.

Winning students have an opportunity to travel and win recognition for their creativity. The five top teams win an all-expense-paid trip to Washington,

DC to present their designs and compete for prizes at the annual NEDC Finals Competition on February 15-16, 2008. The winning team receives \$3,000 for their school's sponsoring department, plus a trip to the 2008 NISH National Training and Achievement Conference, May 4-6, 2008 in Los Angeles, CA. Two additional winning teams will be awarded \$1,500 for their school's sponsoring department.



Students: Thinking about a career in engineering? Maybe you're thinking about getting a degree in [chemical](#), [electrical](#), [mechanical](#), [materials](#), or [nuclear](#) engineering. Did you know that with any of those degrees you can pursue a career in the power industry?

Now is a great time to consider a career that helps run the world! Power generation is the backbone of what makes our economy and society function. Electricity, in some way, impacts nearly every aspect of our lives. From our homes, our businesses, our cars, to our health and safety, our critical infrastructure requires a dependable and economic supply of electricity.

Quick Facts:

- Over the next 15 years, it is estimated that more than 300,000 people will retire from the power industry.
- The International Energy Agency estimates world electricity demand will double by 2030!
- The US Department of Energy projects national demand will increase 45% in 20 years.



JETS and *Power Engineering Magazine* are once again offering the Next Generation Scholarship to help make your pursuit of a power engineering career possible. This \$5,000 academic scholarship is open to all currently enrolled United States 12th grade students. Students expressing an engineering career interest in the power industry and planning to enroll in a four-year engineering program should apply. Check the JETS web site soon for application details.



Take the JETS Challenge and Win Prizes!

[This Week's Challenge](#) [Last Week's Challenge](#)
[Challenge Archive](#)

The JETS Challenge is a weekly word problem posted each Friday during the academic year. Students can submit answers individually, teachers can use the Challenge in the classroom, or engineering clubs can use the Challenge as a team building exercise. How you use the JETS Challenge is up to you.

Win Prizes!

Submit your answer to the JETS Challenge each week (before the next challenge is posted) and all correct submissions will be entered into a monthly drawing to receive a free copy of the new [JETS Assess](#) and [Explore](#) (JETS printed career brochure about engineering careers). There will be five winners each month.

This Month's Winners

Congratulations to this month's winners for their outstanding work. A copy of JETS Assess and Explore will be sent to each of them.

Adam Wied, St. Thomas Moore

DJ Widowski, St. Thomas Moore High School, Milwaukee, WI

Travis Oestmann, Northside High School, Columbus, GA

Julia Hunt, Academy of Richmond County, Augusta, GA

Lacourtney Underwood, Academy of Richmond County, Augusta, GA

New this Year: Engineers Without Borders Activities!



ENGINEERS
WITHOUT
BORDERS
USA

"Building a Better World One Community at Time"

Did you know that 1.2 billion people (out of 6.4 billion) do not have access to clean water. A basic human need? JETS

is pleased to announce a new collaboration with Engineers without Borders - USA (EWB-USA) that will help you and your students explore how engineering is essential in bringing basic human needs to developing countries.

Visit www.jets.org/experience to learn about the [EWB/JETS Classroom Activity](#) and the [EWB/JETS Annual Design Challenge](#).

The **Society of Fire Protection Engineers** is partnering with **Discovery Education** to produce an in-school educational program entitled *The Chemistry of Fire*. In January 2008, The Chemistry of Fire will be distributed nationwide as a teacher's kit to all high school science department chairs in the United States. The kit seeks to teach the science behind fire as a way for students to fully understand the dangers of fire. Additionally, this increased awareness will encourage high school students to become America's future fire protection engineers. **For more information go to: www.sfpe.org.**



This month's activity discusses engineering of fire protection systems. In [Make an Alarm!](#), students are asked to make their own alarm system for something in the classroom. The activity could incorporate fire protection as its primary motivation by focusing on smoke alarms. The activity is designed for younger students, but simply by changing the materials, it could be used to inspire older students. Bringing basic electricity and a buzzer circuit would make this more exciting for older students. Finally, a discussion of how the sensors in smoke detectors work can be provided at a higher level by utilizing additional material (see [How Smoke Detectors Work at howstuffworks.com](http://howstuffworks.com)). After the activity, try having groups of students take apart real home smoke detectors and identifying the sensor and alarm parts of the circuit.

This activity is brought to you by the new [Engineering Pathway](#), a part of the [National Science Digital Library](#). The portal provides high-quality teaching and learning resources in applied science and math, engineering, computer science/information technology and engineering technology - for use by K-12 and university educators. The Engineering Pathway brings together quality engineering education materials from all over the internet allowing teachers to search all of these documents in a single location. This curricular unit is from the [TeachEngineering Digital Library](#) for K-12 engineering curricula.





Society Spotlight:

Society of Fire Protection Engineers

What is Fire Protection Engineering?

Fire protection engineers use physics, math and chemistry to protect people, property and businesses from destructive fires. They analyze how buildings are used, how fires start, how fires grow, and how fire and smoke affect people, buildings and property.

Fire is a noteworthy problem. According to federal government statistics over 3,000 people die, 18,000 are injured and \$10 billion in property damage occurs each year in the United States as a result of fire. In addition to these direct costs from fire, there are indirect costs such as the cost of business interruption. The One Meridian Plaza high-rise fire in Philadelphia that occurred in 1991 resulted in the building never being re-opened. In 1988, the fire in the Interstate Bank Building in Los Angeles resulted in the building being out of use for six months. Other fire costs include damage to the environment, fire insurance costs, and the cost of public fire protection (fire service).

"Because of these substantial losses, it is important that fire protection engineers continue to develop new methods and new products that keep our homes, schools and the workplace safe from fire," said Chris Jelenewicz, Engineering Program Manager with the Society of Fire Protection Engineers (SFPE).

Fire protection engineers use the latest technologies to design systems that control fires, alert people to danger and provide means for escape. Additionally, fire protection engineers:

- Evaluate buildings to pinpoint the risks of fires and the means to prevent them;
- Conduct fire safety research on consumer products and construction materials;
- Investigate fires to discover how fire spreads, why protective measures failed, and how those measures could have been designed more effectively.

Fire protection engineers work with architects and other engineers, state and local building officials and local fire departments to build and maintain fire safe communities. They make recommendations for cost effective fire protection solutions to ensure

that the structure, and the property and occupants contained within are adequately protected.

Careers in Fire Protection Engineering

Fire protection engineers seldom have trouble finding work. In fact, the demand for fire protection engineers far outpaces the number of people qualified to fill the positions. Even with an average starting salary of \$55,000 and an industry-wide mean of \$85,000, knowledgeable fire protection engineers are hard to come by. "There are simply not enough graduates to go around," said George Toth, Executive Vice President, RJA Group.

Furthermore, a career in fire protection engineering provides opportunities for world travel. "In my first job, I spent my first five years traveling internationally, so I got to see a lot of cool places," said Tony Caro, Fire Protection Engineer with the Fire Prevention Bureau & Investigation Division for City of Denver.

As a fire protection engineer there are also opportunities to work in a variety of environments. "I really like it because there are a lot of different areas to work in. Like consulting, working for a town or city government, or working for a code organization," said Amanda Moore, Fire Protection Engineer with Arup.

Fire protection engineers are present in nearly every facet of our society. They are employed by:

- Consulting firms
- Architectural/Engineering Firms
- Fire protection system manufacturers
- Fire marshal offices and code officials
- Military
- Corporations
- Fire departments
- Insurance firms
- Academia/Research
- Federal, state and local governments

Because fire protection engineers design ways to make us safe from fire, many find a sense of purpose knowing they have the opportunity to make a difference. "I feel there's a big reason why I go to work each morning. It gives me an incredible sense of purpose," said Stacey Welch, Fire Protection Engineer, Marriott International.

Great starting salaries that grow with experience also make fire protection engineering a career

worth considering. The Society of Fire Protection Engineers regularly surveys its members to gather salary information. The latest figures are derived from the SFPE *Profile of the Fire Protection Engineer Survey* conducted in 2005, shows that:

- The average starting salary for a fire protection engineer is \$55,000.
- The industry-wide mean among fire protection engineering professionals is \$85,000, reflecting a broad range of years of experience in fire protection engineering.
- Slightly more than 25 percent earn \$100,000 or more.

Colleges and Universities

The [University of Maryland](#) currently offers an ABET-accredited undergraduate fire protection engineering degree; and [Oklahoma State University](#) offers an accredited four-year Bachelor of Science degree in fire protection and safety engineering technology. [The University of New Haven](#) also offers an undergraduate program in fire protection engineering.

Many fire protection engineers begin by earning a bachelor's degree in civil, electrical, chemical, or mechanical engineering and then complete a M.S. degree in fire protection engineering. Many who chose this option earn their degree through a distance learning program. Both the [University of Maryland](#) and [Worcester Polytechnic Institute](#) offer resident and distance learning programs leading to masters degrees in fire protection engineering. "I believe that continuing education is critical," says Sam Dannaway, President with SS Dannaway Associates. "But I couldn't get specialized classes where I live in Hawaii. This program allows me to get the degree I've always wanted."

High school students should take courses that will prepare them for admission to a four-year college that offers an accredited engineering curriculum. Pre-engineering course work should include mathematics, chemistry, physics, and computer science. In college, students spend the first part of their education focusing on engineering fundamentals and their applications. In subsequent years they concentrate on fire protection engineering. This includes courses such as heat and mass transfer; fire risk assessment; fluid mechanics; fire dynamics; water based fire protection systems design; and design of other fire protection features such as smoke management, fire alarm, and exit systems.

Many local chapters of SFPE across the country offer scholarships for fire protection engineering graduate and undergraduate students. In past years, the chapters have found that many of these scholarships have not been awarded for a lack of

applicants. "The last few years we have had very little response to the scholarship. This is true even after contacting the universities that teach fire protection and ask to announce the scholarship to the students," says SFPE Tennessee Valley Chapter President, Monty Overton. The SFPE Chapters are eager for students to apply for these scholarships.

For More Information

For more information contact the [Society of Fire Protection Engineers](#), 7315 Wisconsin Avenue, Suite 620E, Bethesda, MD 20814. Ask for the free SFPE *Guide to Careers in Fire Protection Engineering*. SFPE also has a *Careers in Fire Protection Engineering Website* that can be found at: www.careersinfireprotectionengineering.com.

University Spotlight:

University of Delaware



The University of Delaware, College of Engineering continues a proud tradition of excellence in research, teaching and service that has brought prestigious national accolades to both faculty and students. We host one of the nation's top 20 graduate engineering programs, according to rankings announced recently by The Princeton Review. In this spirit, we encourage you to consider an engineering career that begins at UD. Our undergraduate degree programs in Chemical, Civil, Computer, Electrical, Environmental & Mechanical Engineering provide an exceptional educational experience that prepares our graduates well for challenges in industry, government and academia.