ENGINEERS' FORUM

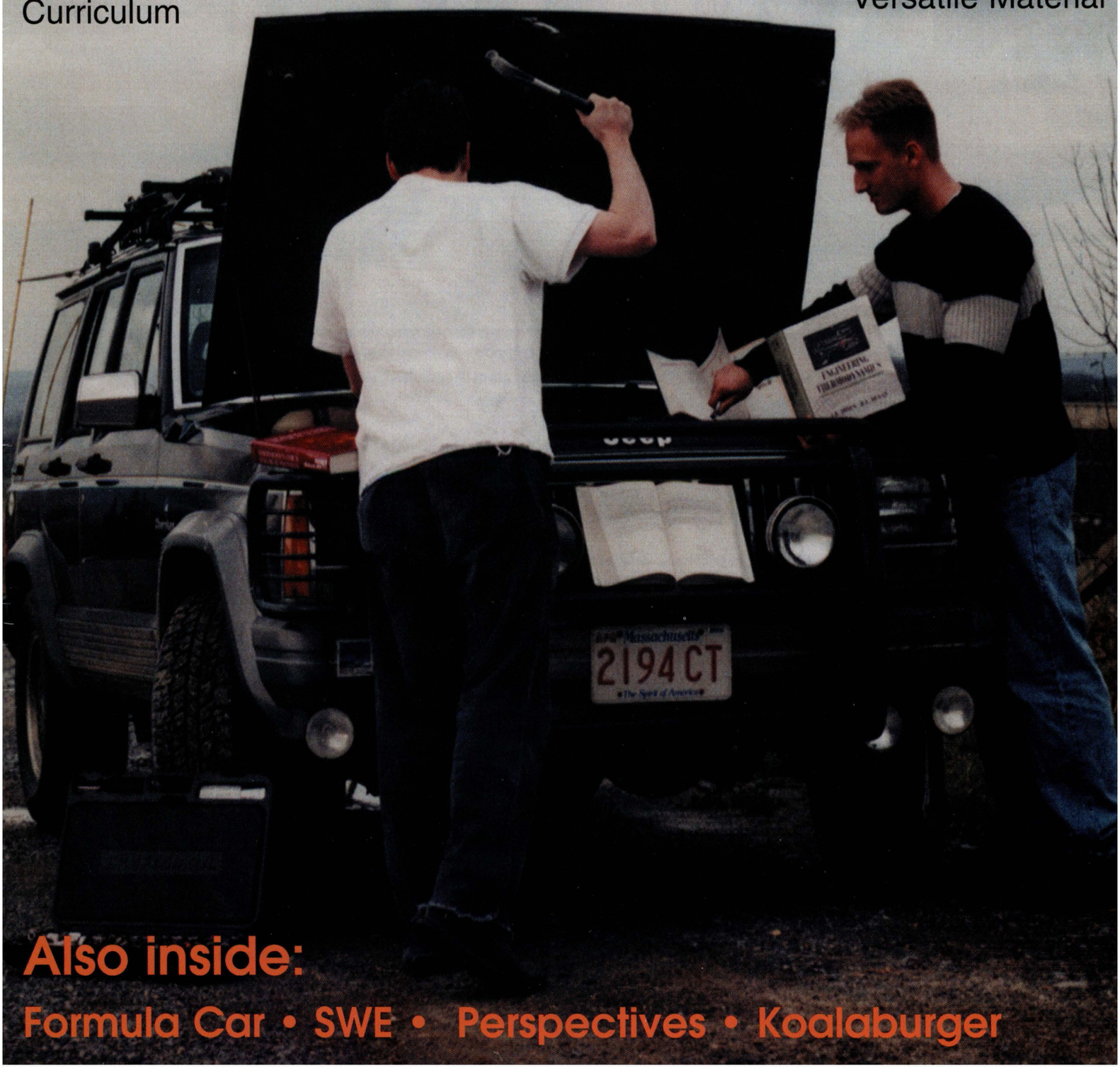
VOLUME 19 • NO 2 APRIL • 2000

Frith Lab Fun

Practicality of Freshman Engineering Curriculum

Plastics

The Worlds Most Versatile Material



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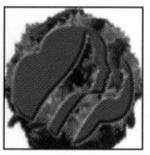
contents



local

3

girl scouts invade virginia tech!
The Society of Women Engineers brings science and exploration to area girl scouts.
contributed by Julie Prudich

perspectives

4

perspectives
Students views on engineering and the world at large.
by Shuvom Ghose, and Ted Hessing

history

8

plastics: from the beginning
A quick look at the background of the world's most versatile material.
by Chris Thaiss

technology

10

engineering for speed
Tech's Formula Car Team pushes the limits of performance.
contributed by M.K. Abali

feature

12

cover:

frith lab fun
Freshman design lab goes from the classroom to the carburetor.
by Ted Hessing
•cover photo by Jason Gibbs

news

15

associated news:
Marinated Marsupial Makes News
by Tokus Boulous

history

16

engineering wonders of the modern world and the people who built them.
by Tom Catherwood

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Editor's Note

Hello, readers. Welcome to the new Engineers' Forum. We, the editors and staff of this fine magazine, are beginning our rebellion against mindlessly boring content. This is the first issue of our new mindset, and this is some insight into the reasons that provoked us to this state.

Our goal is to intrigue, inspire, and indulge our readers with the wonders of engineering. Some people complain that engineering is boring and uninteresting. Well, that's fine. We have felt that way too. However, this particular staff also has a passion for the creation of things and the endeavors of the mind that make our society possible. We remember well the sense of achievement we felt when we constructed our first structures of Lincoln Logs, Tinker Toys and Legos. We remember our wonder (and our parent's downright horror) when we disassembled everything our hands could reach. We also remember the tremendous sense of accomplishment when we got our first college design project completed and working superlatively or we aced a particularly difficult test.

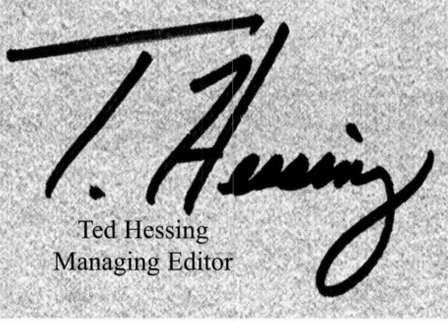
For the longest time engineers have held a dual sense of amazement and drudgery. Our staff experienced the same phenomenon recently, but we have realized that it doesn't have to be this way. Engineering is fun and exciting. There are no two ways about it. To reflect our new discovery we are presenting the Forum in a new manner.

Our cover features two students attempting to fix a car by means of a hammer and several thermodynamics texts. Any auto mechanic will tell you that this approach will get you nowhere fast. In this issue we examine steps that the College of engineering is taking to make undergrads more aware of the practical side of engineering.

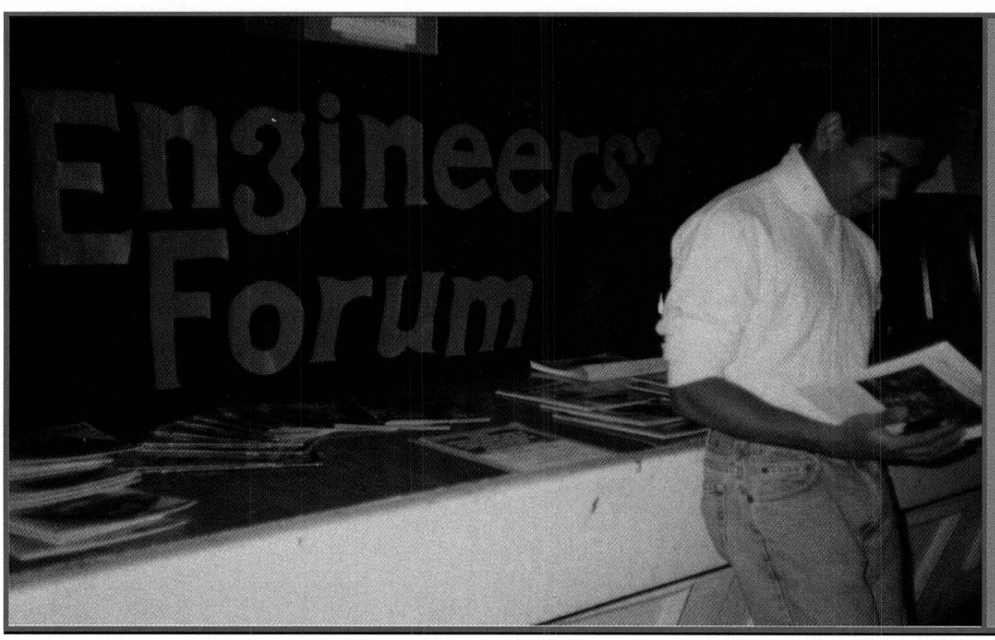
The issue continues its salute to engineering through the ages by reviewing some of the most impressive structures of our time in Engineering Wonders of the Modern World and the People who Built Them. This tribute takes a modern turn and continues in Engineering for Speed as a student member of the team relates the story of the Formula SAE team of Virginia Tech. The world of plastics is also examined in this issue.

But, as we all know, engineering is not for the weak of heart. Achievement in this most rigorous of fields comes from the questioning of practice and rebellion. This issue sees the dawn of a new standard column Perspectives where students can voice their opinions on any topic. We hope that all of our readers will respond and be printed on these pages.

Well, that's our story and we're sticking to it. Read and enjoy!



Ted Hessing
Managing Editor



Here at the Engineers' Forum, we're always looking for new members. If writing, photography, graphic design, or marketing appeal toyou, you appeal to us. Find out more by emailing us at forum@vt.edu or coming to our meetings 5:00pm Mondays in 333 Norris.

Girl Scouts Invade Virginia Tech

contributed by Julie Prudich (ChE '00)

If you were in Randolph Hall Saturday, February 12 you would have heard something unusual – the sounds of 68 area Girl Scouts. The third through sixth graders were there to learn about things like friction, profit margins, design, stress, polymers and teamwork. And they did all of that and more by participating in hands-on activities designed for them, culminating in the afternoon with a patch for their sashes reading "EXPLORING ENGINEERING 2000".

This was the fourth year the Society of Women Engineers (SWE) had hosted the event. The program was originally designed to meet one of SWE's goals – to encourage young girls to study engineering. Every year, the SWE chapter invites the local Girl Scout troops to participate in this event on the Virginia Tech campus. This year's attendance was low due to forecasted weather problems; usually 150 girls and parents participate.

The program was originally designed to meet one of SWE's goals – to encourage young girls to study engineering.

The girls rotated through four stations run by SWE members, each emphasizing a different major. In the chemical engineering station, Terri Kurfurst (ChE '01) helped the scouts make slime out of Elmer's Glue and Borax and discussed characteristics of polymers. The girls were excited to take home their experiment! In the mechanical engineering station, Anna McEntee (ME '00) and Katie Gray (CpE '02) demonstrated some aspects of car design using the autonomous vehicle. Then in pairs, the girls were given various recycled supplies with which to create their own cars. One resulting car was built with a Pepsi can body, pencil axle, and canister lid wheels.

The scouts spoke of profit, operating costs, inventory, and demand in the industrial systems and engineering station. Alison Hammock (ISE '00) led them in a hypothetical plant "game" to illustrate the concepts. In the last station Cindy Dotson ('03) and Melissa Harrison ('03) had the girls work in teams to design a bridge while talking about civil engineering. They were given limited supplies including tape, foil, toothpicks, and string and their creations were tested by seeing how many pennies they could hold.

The Exploring Engineering activity is one of SWE's favorite outreach projects. Thirty Virginia Tech students made it possible, and the area girl scouts left excited to return next year to see what activities would be done. If you're interested in helping with Exploring Engineering Day (Girl Scout Day) or in joining SWE, email the society at swe@vt.edu or stop by the office in 216A Hancock Hall. EF

Photos courtesy of Julie Prudich

Lft: Three scouts test out the autonomous vehicle in "follow the leader." Ctr: Katie Gray aids a team in making a vehicle from recycled goods. Rt: April WIlliams watches on as the girls mix their slime.

PERSPECTIVES

No More Excuses...Please!

Shuvom Ghose

Though it took us 127 years to get there, Virginia Tech's engineering college has finally ascended to national prominence by surpassing all other accredited schools in the production of knowledgeable, highly-trained, energetic whiners.

No longer must we bow down to traditional powerhouses like MIT; Tech produced more gripers last year than they did by 42%. No more must we take second place to massive schools like Illinois State; our whiners have been rated more disgruntled and childish than ISU's by 4 out of 5 impartial judges. Finally, Tech stands alone atop the complaining world.

Whining is, after all, the manner in which this country received its birth.

Luckily, as a tutor in an engineering assistance center and a member of a senior design team, I have access to two of the most active orchestras producing that beautiful symphony of disgust. Although in my younger days I could give out the occasional malcontent toot, I have, sadly, lost the talent to generate such elegant concertos of complaint as the people found there.

Once I noticed that a student I was helping in the tutoring center was using a pen to do his homework instead of the standard mechanical pencil the EF department mandated in my day.

"Yeah, I like using a pen better," he replied after I asked him about it. "That stupid EF department is always trying to make us conform to one another. I'm not a conformist, I like doing it my own way, and my way works better." The student then proceeded to scratch out four entire lines of equations on the homework paper he was going to hand in, being unable to erase little mistakes as his silly "conformist" colleagues could.

How well it speaks to the caliber of our new students that they can, with less than 2 months of experience, point out critical flaws in the way a 127-year-old institution nationally ranked in undergraduate engineering excellence trains its members! Amazing!

Sometimes, two complaint soloists combine unknowingly to produce dazzling duets of disapproval.

"Why do we have to learn this Statics stuff?" I heard one leader of tomorrow whine in the center. "Who cares about all this garbage?" Two tables away, I sat down to help a student with her Deforms homework.

"I don't know how to find the shear force at this point," she said.

"Well, just find the reactions at the ends of the beam, and then draw a shear-moment diagram." She looked puzzled.

"A what diagram?"

"A shear-moment diagram. Remember that from Statics?" The student slumped her head between her hands.

"Statics? We have to use that? Why didn't I learn that stuff before?"

But my favorite complaint by far is the classic: "I just don't learn that way." I have heard this gem from students in the tutoring center, tutors in the tutoring center, and even seniors in my major. And it never fails to bring a sigh to my chest. The conversation usually goes something like this:

A friend: Hey, Shuvom, did you get number two of the homework?

Me: Sure, why not?

Friend: Because it didn't look like the prof went over that in class.

Me: He didn't. It was in the book.

Friend: The book? (Thoughtful pause) Maybe I'll just go in and see the professor during office hours.

Me: No, it's easy. Just read the section and you'll be able to do it.

Friend: (Shaking head) No, I can't just pick up the book and read it.

Me: Why? Don't you have the book?

Friend: Yeah, but *I just don't learn that way.*

Me: What, you can't read?

Friend: No, it's just that *I just don't learn that way*. It's too hard to understand. Some people can pick up the book and

understand everything, but I can't.

Me: Well, how are you going to ever acquire that skill if you always get other people to explain things to you?

Friend: I don't know. Look, do you know when the teacher's office hours are?

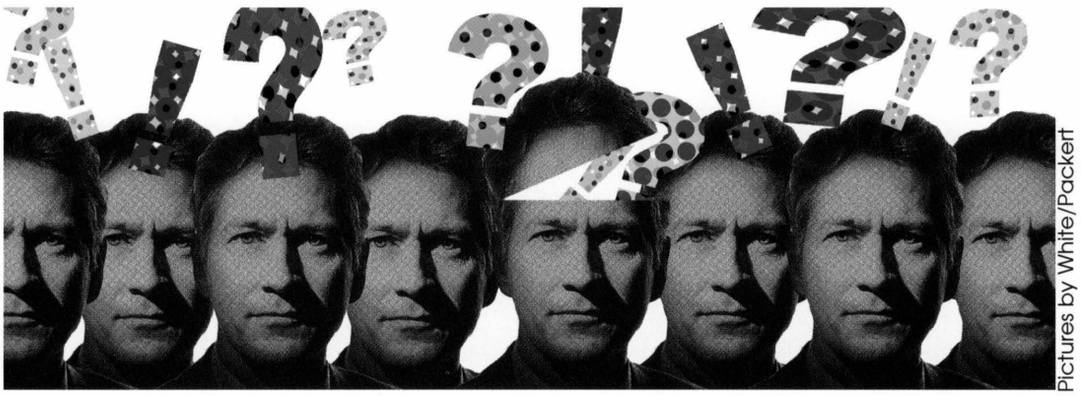
Me: (Sighing) No, but it's on the syllabus.

Friend: The syllabus? (Thoughtful pause) Maybe I'll just e-mail him.

Whining is, after all, the manner in which this country received its birth. What was the Declaration of Independence, really? The first third contained some high sounding language about liberty and justice for all, but the last two-thirds were just numerous complaints rich white guys over here had against rich white guys on the other side of the Atlantic.

So historic was this gripe that the people who decide this sort of thing righly choose July 4th, 1776, the Declaration's signing day, as the birthday of our nation. This makes much more sense than chooing October 19th, 1781, (the day the British army surrendered at Yorktown), or September 17th, 1787, (the day the Constitution was signed), since the five years of war and six years of awkward anarchy that followed the Declaration were really just formalities. Our nation was born the day it came together to complain.

Therefore, drink in the cacophony of complaint you hear all around you; it is as American as the Fourth of July. Notice the different and complementary flavors of whining that engineers make: Some whine by boasting ("I finally finished that d--n program"), some whine by questioning ("Are you going to that useless class today?"), and some just pure whine ("I hate this stupid course!"). But whatever pitch of complaining you notice, above all notice that every corner of Randolph reverberates with it. It is, after all, what Virginia Tech engineers do best. EF



Pictures by White/Packert

PERSPECTIVES

A Grave Injustice

Ted Hessing

Of the events of the past year, one in particular stands out in my mind as the greatest committed under the pretense of justice. I am not speaking of political scandal but of a true danger to the American way of life. I am referring to the antitrust case brought against Microsoft.

The government's antitrust case against Microsoft is a travesty of truth, justice and morality. Microsoft has been condemned for the sin of being exceptionally successful.

The fundamental value our country was founded on is the right to one's own life, possessions, and the product of one's work. This means that Americans have the right to trade freely with others. These most sacred tenets include the right to make a profit, as big a profit as it is possible to earn in a free, unregulated market.

Companies exist for a single purpose: to earn money. They do not exist to make the world a better place or to free humanity from a specific burden. It is interesting to note that the same virtues that enable the accumulation of wealth (superlative achievement by the creation of a product or a service in a manner better than any or all competitors) are the same virtues that make the world a better, easier place to live. The government has brought this case against Microsoft in the name of 'the public good.' What is the 'public good' if not these things? Perhaps those opposed to corporate success are actually opposed to the virtues and benefits such success represents.

The government has no right to dictate to Microsoft the terms of its existence. It claims the right to regulate Microsoft's prices, products, contracts, and methods of competition. It has no such right.

There have been claims that Microsoft is a monopoly. This is patently false. Privately held corporations, such as Microsoft, cannot be a monopoly because only the coercive power of government can create a monopoly. Private concerns have no power to forcibly suppress competition. The only the institution that forces others to its wishes by the power of the gun is the government.

The government's antitrust case against Microsoft is a travesty of truth, justice and morality.

Photo by Ted Hessing

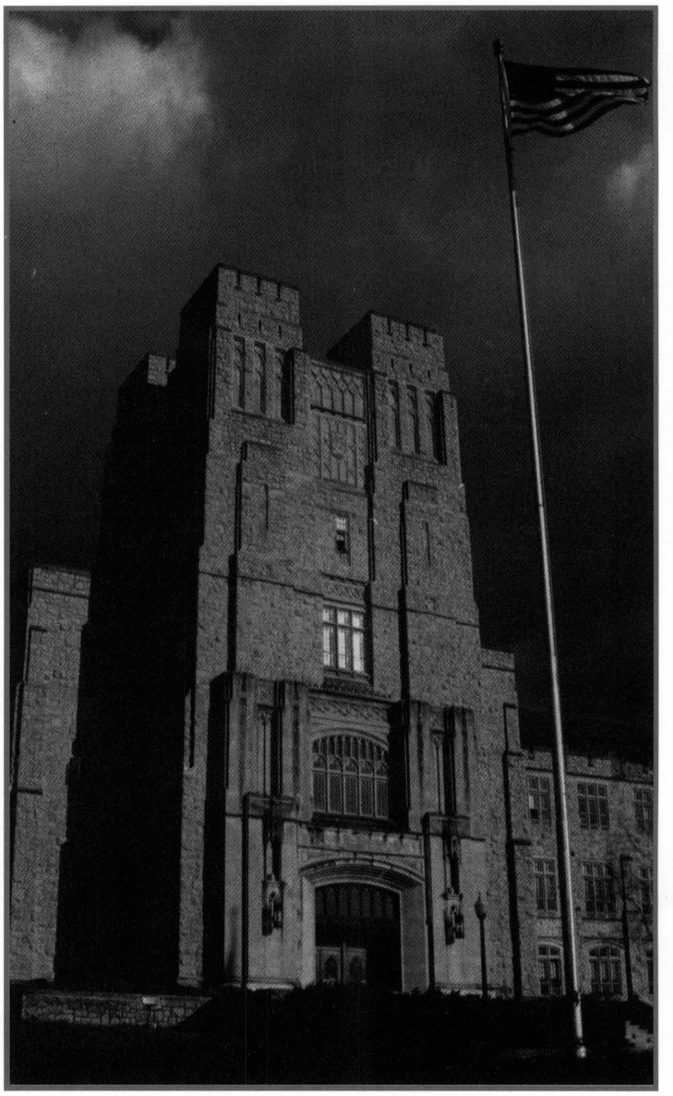
There have been claims that Microsoft has coerced its customers into buying its product. This is also false. Microsoft has no power but that of voluntary trade; a system in which either party may refuse to participate.

There have been claims that the customers have been harmed by Microsoft's approach to the dissemination of its browser, Internet Explorer. These same claims maintain that competition has been stifled because competitors cannot sell their browser when a company is giving one away for free. This is ludicrous. Many flavors of UNIX are freely available, yet Microsoft still sells several versions of operating systems. The reason is simple: for many people the Microsoft version is better. For those who believe that other systems are better they have the right and ability to use them. Customers, in a free society, always have the right to purchase or not to purchase a product. Microsoft also has the right to make their products available to the public as they wish. The price they choose to place on their products is none of the government's business.

The only result of government control will be less innovation, higher prices, and less competition. Americans and Microsoft must not concede their rights by allowing the government to regulate our business practices. Citizens and the corporations that they control should maintain that their existence was granted not by permission, but by inalienable *right*. BF

In support of the Seventh Circuit Court of the United States

Ted Hessing



Last semester, editors of college newspapers across the country printed articles discussing their views on a case pending trial in the United States Supreme Court; The Board of Regents of the University of Wisconsin v. Southworth. At the heart of the issue is the fact that the university compels its students to pay a broad-base fee for the support of special-interest organizations. The Seventh Circuit Court of the United States has decided this action violates the first amendment principle of the banning of compelled speech.

The editors maintain that the students at the University of Wisconsin have not participated in compelled speech. This is an obvious fallacy. Webster's dictionary describes an act of force as 'compel by physical, mental, or moral means; to compel the acceptance of.' By revoking the enrollment status of a registered student for the failure to provide the staple sustenance of organizations of which that student has no interest or commitment to, UW (or any other institute of higher learning who performs similar practices) has committed an act of force. Literally, UW has compelled Southworth (and every other registered student it has fleeced) to perform compelled speech. The crimes of higher learning extend beyond this however.

The editors of Virginia Tech's own Collegiate Times stated in their October 13, 1999 op-ed that, without student funding, 'the right to free speech (of organizations without funding) would indeed be violated, as they possess the same right to be partially subsidized by the university as any other student organization on campus receiving funding.' In this statement the editors are absolutely correct, each group has equal rights to funding. What they seem to miss is the fact that NO GROUP HAS THE INTRINSIC RIGHT TO FUNDING.

If each organization has members and patrons interested in its continuation those members should be willing to support it. Whether by donation of time, money, or effort the members of each organization should reap the benefits of their own labor, not siphon funds from the pockets of private individuals who have their own interests to attend to.

The Collegiate Time's argument that "All funding is appropriated using neutral criteria to ensure against biases, and the money is used to support a wide variety of organizations" is invalid. Of course the appropriation of funding is biased. If the funds were eliminated, the organizations would have to rely on the support of members. If the members of an organization are not willing to put the time and effort necessary to sustain their interest why should money be pilfered from the student body to ensure their existence? Would not the money that is collected from students be better spent according to each individual's needs and desires? Why should private citizens who earn compensation for their hard work be forced to remit a portion of it for the benefit of those who claim that by the default of their existence alone they are entitled to subsidy? Why are those who earn money to support organizations forbidden the choice of what organization, if any, is to benefit from the support of their dollars? The University's approach is tantamount to theft. Public universities through out the country are acting as a misbegotten Robin Hood; they steal from those who are capable of earning and give to those who are not.

Wealth is the property of those who create it. It should not be distributed on the whim of others. When you violate that principle you violate the most basic right of man, the right to the product of his own effort. EF

NO GROUP HAS THE INTRINSIC RIGHT TO FUNDING.

Plastics: From the Beginning

by Chris Thaiss

Plastics have made it possible to go from the old days of vacuum tubes and miles of wiring to compact electronic devices that can sit on your desk or in the palm of your hand. Just look around, how many of the objects are made of plastic? The outside shell of almost every computer is made entirely of plastic. Floppy disks, ZIP™ disks, and CD's are all made of plastic. The circuit boards inside the computer are mostly plastic, and the insulation on computer wiring is all plastic. Imagine what typing on a keyboard would sound like if it wasn't made of plastic but of metal, assuming you could even get such a computer to function.

Photo by Jason Gibbs

The first economically viable form of plastic was formed from refined crude oil in 1909. This early plastic was named Bakelite after its inventor, Dr. L. H. Bakeland. Bakelite was made from a combination of phenol and formaldehyde and provided rigidity, lightness, strength, heat resistance, insulation, and the ability to mold to products. The strengths of Bakelite were initially utilized in the electricity generation and supply industry. Prior to the 1950's, the uses of plastic were limited to military and government applications including aircraft canopies during World War II. However, after World War II America experienced both an economic and social boom. More people owned or were buying homes than ever before. As American cultural identity shifted to a suburban mindset, plastics found their niche.

Plastics revolutionized toys, furniture, housewares, houses, cars, electronics, medical devices, and other 1950's amenities. The Hula-Hoop, our ever-present cultural icon, was made possible by plastics. Sterilization of medical equipment was made easier and more efficient with plastics. Plastics increased gas mileage in cars, increased the performance of aircraft, and have increased the safety of everyday life.

One of the greatest inventions in the century, the transistor, revolutionized the electronics industry. However, without plastic there is no such thing as a transistor. When Walter Brittain and John Bardeen experimented by placing strips of gold foil around a plastic triangle in point contact with a slab of germanium and built the first transistor in 1947, they opened the door for future research into the practical uses of plastic.

Plastics give designers an incredible amount of flexibility when creating products to meet societal needs and demands. Yet, there are always drawbacks to great inventions. Some plastics are extremely toxic when ingested or inhaled, and with the increased use of plastics, disposal has become a problem. The problem of waste disposal is being turned around by an increased recycling commitment in our communities, such as Virginia Tech's recycling center. By recycling more, less waste is generated, and more of the initial energy that it took to create a soda bottle or a milk jug is retained. The toxicity issue with certain plastics, and their impact on human health, can also be resolved. Since only some plastics are extremely toxic, everyday household items are not constructed of

Did you brush your teeth today? If that brush was not made of plastic what would it be made of? Wood... That would work, just make sure to have a pair of twezers ready.

these materials, and when these toxic materials are handled in industry, they carry detailed warnings and precautions. Most companies that deal with toxic types of plastics will not allow people without proper training to handle them.

It is very hard to imagine a world without plastic. Think about credit cards, contact lenses, food wraps, car parts, and shoes, and how different they would be without plastic. Did you brush your teeth today? If that brush was not made of plastic what would it be made of? Wood? Metal? A metal handle for the brush might be alright, but the expense of a toothbrush, and the weight would not make them as economically feasible as they are now. But what about a wood handle? That would work, just make sure to have a pair of tweezers ready. If not the handle, how about the bristles? Would you want to spend your morning brushing your teeth with tough grass or stiff animal hair? Where would we be today without plastics? EF

plastic codes and what they mean:

1. Polyethylene Terephthalate (PET or PETE): This is clear tough and has good gas and moisture barrier properties.

2. High Density Polyethylene (HDPE): This refers to a plastic used to make bottles for milk, juice, water and laundry products.

3. Vinyl (polyvinyl Chloride or PVC): Used for bottles and packaging sheets as well as pipes.

4. Low Density Polyethelyne (LDPE): Used mainly for film applications because it is tough, flexible and relatively transparent. Also it is used for heat sealing.

5. Polypropylene (PP): This has a high melting point which makes it good for holding hot liquids.

6. Polystyrene (PS): This is rigid or foamed and is good for protective packaging, containers, lids, etc.

7. Other: Made with different resin than the other 6 or is made of more than one resin.

•info courtesy of American Plastics Council

Engineering for Speed

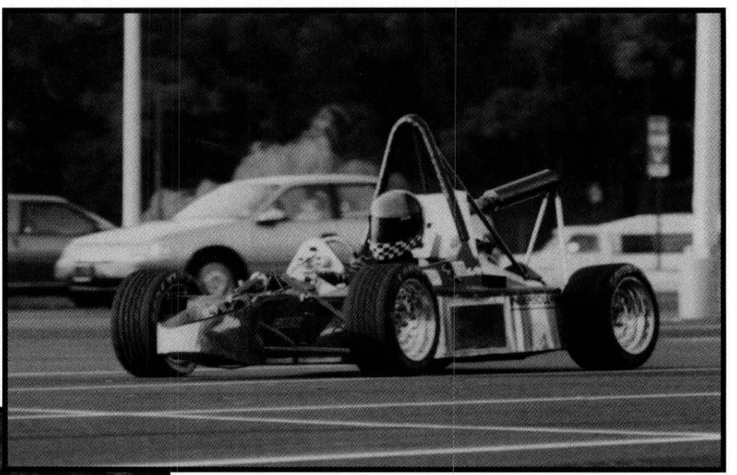
by: M. K. Abali

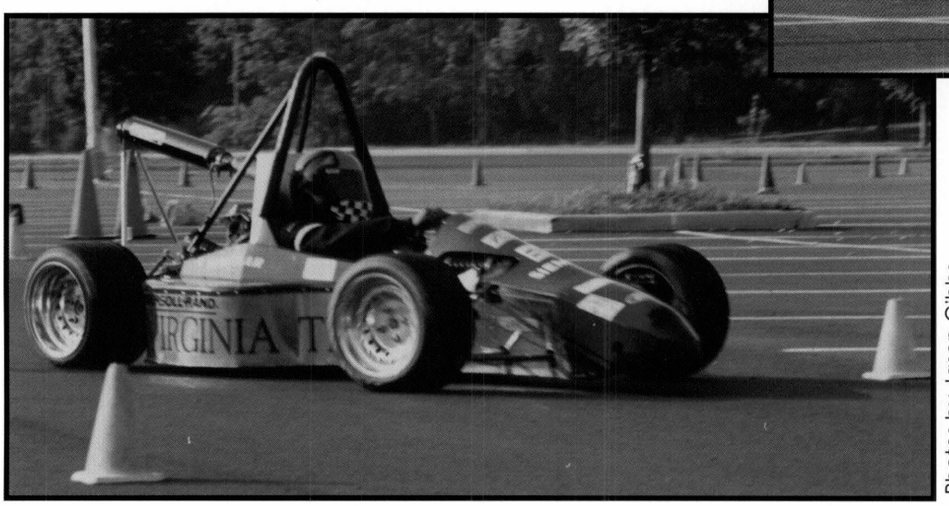
Each year 40 some mechanical engineering students dedicate endless hours in the Ware Lab to design and build a racecar to graduate, and more importantly to beat 120 other schools from around the globe in the most prestigious student design competition organized by the Society of Automotive Engineers.

What is it?

Formula SAE first started in 1982 as a learning experience for mechanical engineering students who were considering a career in automotive and/or racing engineering. Funded by three major automotive manufacturers and an endless list of industry suppliers, formula SAE soon grew to a very competitive and innovative racing series. Former members of the Virginia Tech Formula SAE team are now shouldering very important duties in teams and industry leaders such as, Ganasi-Target Racing, Penskee South, and Ford Motorsports. Furthermore, every year the majority of senior team members are hired by the automotive industry.

Every May the main event takes place in Pontiac Michigan. A growing number of schools compete in a four day test of endurance (both cars and the crew), speed, and engineering. The fruit of an entire year's work is displayed to professionals from the racing industry in different dynamic and static events. The cars are judged by their engineering and manufacturing quality, by cost efficiency and most importantly by their speed.





Photos by Jason Gibbs

How fast is it?

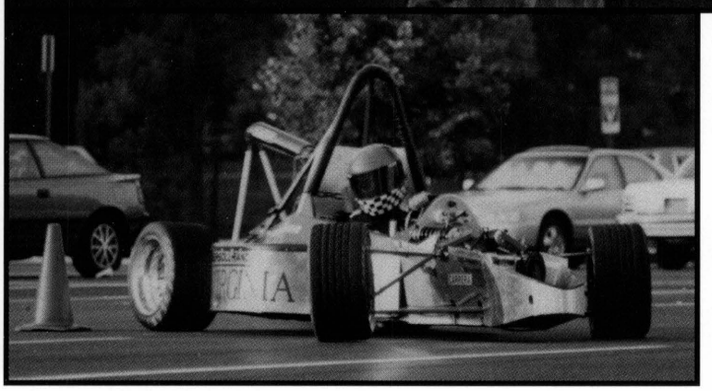
Driving an FSAE car is a unique experience. First time drivers usually leave the car with their hands shaking. Performance numbers for the FSAE car are stifling. 0-62 mph (100 km/h) in 3.2 seconds! 1.3 g of lateral acceleration on the skidpad! These numbers are astounding for a common production car, but the FSAE posts them with ease. The top speed usually runs around 100 mph which is plenty exiting for a 500-lb. car with a 72" wheelbase.

Performance Specs:
0-62 mph (100km/h) in 3.2 secs!

The Race

The nature of an FSAE course can be explained as low to medium speed, high acceleration, high handling, autocross style road course. The annual FSAE event involves four different races in which 65% of the total point in the event is awarded. These races are 100 meters acceleration, 20-ft. radius skid pad, small autocross and large endurance course. The races test the car on all the aspects of the racing from acceleration to mechanical durability.

Besides the FSAE event, FSAE



team of Virginia Tech races in the SCCA Blue Ridge region Solo 2 autocross series. The team races in the A-mod category, competing against the fastest cars. The team has a consistent history of success against other professional teams with bigger budgets.

The Rules

Like every other racing series, FSAE has a set of rules, with which the teams must comply. These rules are usually design to protect the driver and the crew from safety hazards. Unlike some other series, the performance and innovation end of the rules are open, which provides an opportunity to make the cars faster every year.

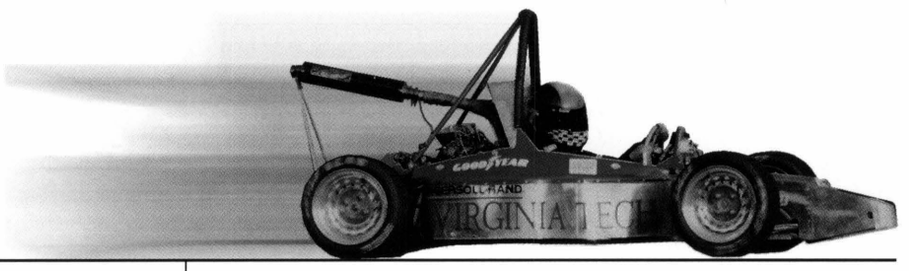
Who is working in the team?

FSAE team of Virginia Tech is a student design project funded by the Mechanical Engineering department and corporate sponsors. The team is open to all majors from all levels as long as they are ready to get their hands dirty. The team meets every Monday at 4:30 PM in the Ware Lab classrooms and new candidates are welcome to come to the weekly meetings.

What are the benefits?

Besides the fact that active membership in the FSAE team of Virginia Tech is an excellent addition to any resume, it also provides an opportunity for the practical engineering and hands-on experience that is crucial in the automotive industry. Extra benefits include the betterment of professional qualities, discipline, team work and people skills. Joining the team early as an active member is very critical and encouraged due to the complexity of the project. EF

The top speed usually runs around 100 mph which is plenty exciting for a 500-lb. car with a 72" wheelbase.



Frith Lab Fun

by Ted Hessing

Location: *XYZ Corp. performance lab*
Setting: *Joe Hokie, recent engineering graduate, 10 AM.*
Technician: *"So, Jim, the motor's blown. What should we do?"*
Joe: *"According to the spec we'll have to perform a level 3 system diagnostic. You start the preliminaries and I'll review the plans. I hope you can stay late, this could take all night."*
Technician (shakily): *"Uh, sure Jim. I'll get right on it."*

6 Hours later:
Joe (reporting to the Chief Engineer): *"... and so I looked through the electrical plans for the motor and it seems to me that we may be drawing too much current through the controls system. I'll remove that segment tomorrow for further study."*
Chief Engineer: *"So the motor is still inoperable. This is completely unacceptable; we need that piece for integration tests."*
Technician: *"Uh, sir? I beg your pardon but the motor* is *operational."*
Joe: *"What?! How? That's impossible! I haven't finished my analysis yet!"*
Technician: *"Well I just checked the spark plugs...turns out one of 'em was fouled. I found a replacement and it seems to be working fine..."*

Meanwhile at Virginia Tech:
Freshman Janet Hokie is taking apart a Black and Decker hand-held drill in the Frith Practical Engineering Laboratory. The hands-on practicality of her assignment will serve her well in the not-so-distant future.

As the song goes, it's sad but true; a thorough engineering education does not prepare a student for all eventualities that they may encounter in the field. Sometimes a mundane concern such as spark plug operation may be over looked in the faculties quest to insure that students know all the intricate details of Fermat's Last Theorem, have the periodic element table memorized, or master other such esoteric but essential items of academia.

Photo courtesy of Richard Goff

Students at the Frith Lab enjoy taking gadgets apart and putting them back together again.

Although solid background in technological essentials such as physics, chemistry, and analytical mathematics have remained constant in the foundation of engineering education, students find themselves laden with graduation requirements seeking to instill an appreciation and fluency in abstract theory. Cries of 'When will I ever need to know this on the job?" can be heard echoing through the halls of Randolph, McBryde, and other classrooms across the Virginia Tech campus. While students have long been browbeaten into acquiescing that mastering difficult, often uninteresting subjects will expand their capacity to think and reason they still wish that they could be spending their time on more practical and pertinent quests for knowledge. Away from campus employers spread across a myriad of industries wish that their new hires, fresh out of college had more experience in the realities of production.

To combat such qualms of students

and those hiring them, Virginia Tech has implemented a more practical approach to education. Without sacrificing academic content, required curriculum has been filled with design and laboratory courses designed specifically to supplement an undergraduate's education.

This shift towards a hands-on curriculum is a return of sorts for the engineering faculty. Previous to the '70s and '80s, the College of Engineering had fostered development of practical skills side by side with those of a professional nature. That curriculum was subsequently modified in favor of more theoretical material with the intention of creating a more scholarly engineer.

The modern curriculum has been supplemented in the past few years by the creation of the Frith Practical Engineering Laboratory. Revised Engineering Fundamental (EF) courses that every incoming freshman is required to take currently require students to use basic hands-on skills in an engineering manner by analyzing physical systems in the Frith Lab. Dr. Richard Goff explains the reasoning behind the changes: "A lot of the students that come up today are interested in computers. They don't tend to tinker with things as much as they did in the past." Dr. Goff believes that implementing physical design and reverse-engineering practices into the curriculum can compensate for possible physical skill deficiencies. Hands-on experiences in the Frith Lab provide a means for students to ease into the physicality of engineering. By altering course requirements so students must use Frith Lab facilities the faculty is trying to teach "students that didn't traditionally spend a lot of time messing with physical systems" essential practical skills.

The entrance of a freshman design lab into undergraduate curriculum can also be seen as a way for the College of Engineering to combat recent complaints of women engineering students that feel left out of the loop. "It is a rarity that young girls spent a lot of time working on cars or fixing the family lawn mower." Says Goff. "We thought that it would be a good thing to get women more involved as well in the hands-on experience of engineering."

The true innovation of incorporating hands-on design experience was begun in the Fall of 1999 when freshmen engineering students were given the option of enrolling in a 1 credit design elective course, Engineering and Design Lab EF 2984.

Dr. Goff began the freshman design lab in order "to add another dimension to their education… an introduction to engineering in the physical sense." He believes that: "The idea of teaching forces and moments…Just taking a flywheel off an engine can give a student a sense of (the principle of) a moment and the forces involved in it."

The description of the freshman

Benefits to students enrolled in this design elective are enormous.

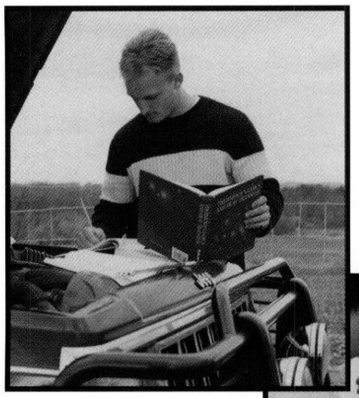
The Frith Practical Engineering Laboratory has only been possible because of the generosity of Ray and Violet Frith of Martinsville, Virginia. Both Mr. and Mrs. Frith are natives of Henry County, Virginia. Mr. Frith is a 1951 Virginia Tech graduate, having earned his B.S. Degree in Agricultural Engineering. He subsequently founded and was president of Frith Construction Company of Martinsville, an industrial and commercial construction company. Part of the gift from Mr. and Mrs. Frith was used for renovation of the space for the Lab, and the remainder is an endowment for support of ongoing activities of the Lab.

Corporate sponsors of the Frith Lab include Lockheed-Martin and General Motors. Other sponsorship was provided by an unprecedented gift of $10,000 from the Student Engineers Council from earnings from their highly successful Engineering EXPO, which brings hundreds of engineering employers to campus each to recruit Virginia Tech Engineering students for permanent jobs as well as Co-op jobs and internships. Corporate sponsors who have donated specimens for the hands-on activities include Kodak, Briggs & Stratton, and Black & Decker. The Southeastern University and College Coalition have provided additional support for Engineering Education (SUCCEED), a National Science Foundation educational coalition.

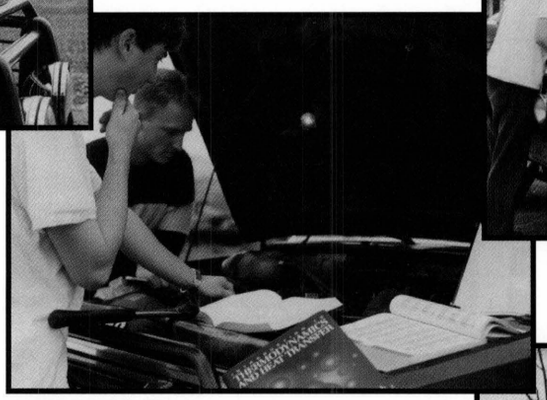
design elective could read as follows: "Come play with Robotix for course credit." Students get to take things apart and put them back together for grades. A typical favorite among students is the Robotix course challenge where students build semi-autonomous vehicles from the popular Robotix set series to navigate an obstacle course. Students go to the course website to review the week's upcoming activity and then come to class ready to perform the lab activities. The students are graded on attendance, teamwork, lab journals, (which store lab notes and sketches of various projects) and a final team presentation on their favorite lab or a lab that they would like to see implemented.

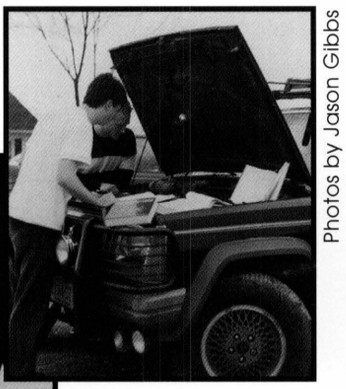
Students get to take things apart and put them back together for grades.

Benefits to students enrolled in the design elective are enormous. In a typical freshman year that is filled with theory that creates the basic foundations of engineering science the Freshman Design Lab offers students a chance to work with actual, physical systems. While most of their colleagues would claim no technical experience, students seeking internships or co-ops in their sophomore year would be able to impress prospective employers with a recount of their course experiences. Additionally, Dr. Goff maintains that course grades are usually high in the design elective thus suggesting a GPA incentive for the course as well.

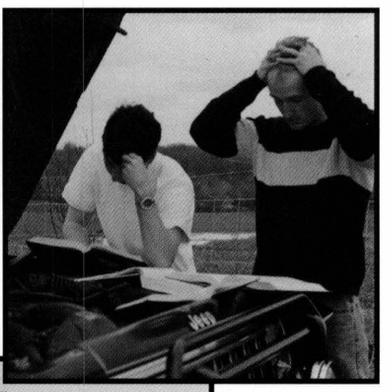


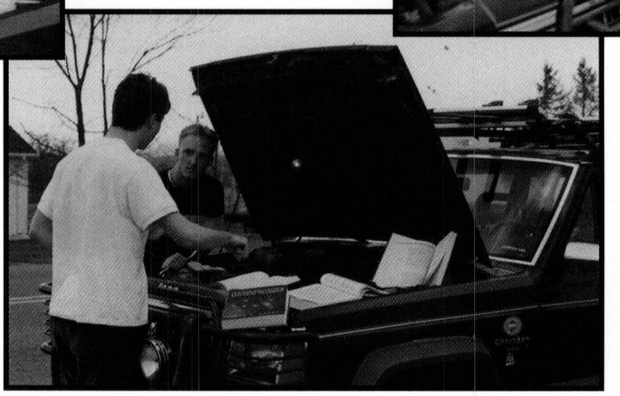
These books might get you an "A" bur don't expect them to help you fix your car.





Photos by Jason Gibbs





The Freshman Design Elective is not the only means that new engineering students can gain vital practical knowledge. Several campus clubs are open to students of all majors, all levels, and of all interests. A brief list of such organizations is:

- Engineers' Forum: "Virginia Tech's Premier Engineering Magazine"
- Hybrid Car Team
- Phantom Submarine
- Formula Car Team
- Society of Women Engineers
- Association of Computing Machinery

Although the lab was a tremendous success the EF administration anticipates the shift of the lab into the regular EF 1015 and 1016 classes. "Our ultimate goal" says Dr. Goff "is to incorporate the activities into actual classes, so the concepts we teach are reinforced by hands-on activity." Preliminary ideas of EF changes for the future would include several small design tasks incorporated into the early EF classes.

Whatever the future holds for freshmen, it seems more and more likely that practical activity is here to stay. Perhaps one day there will even be a course on spark plugs... EF

Food Review: Koalaburger Tops List

by Tokus Boulous

New research, serendipitous discovery vindicate ostracized Virginia Tech.

BLACKSBURG, Va.- Old Bossy can breathe a sigh of relief-at least for a short while. In what amounts to nothing less than an astounding discovery, a team of Virginia Tech Meat and Poultry researchers, curiously spearheaded by Electrical Engineering student Christopher Richardson, have discovered that the koala makes the tastiest burger-ever.

Subjects in the controversial study were given ground meat patties from several traditional sources, such as cattle, bison, and deer, along with koala, and asked to rate the food on texture, aroma, and "overall tastiness." Koala was consistently ranked first.

"I first came up with this theory when I noticed a trend in the way people enjoy meats" says Richardson, who notes that, if it were possible, he himself would eat a panda. "The cuter the animal in question is, the tastiest that animal is. Just look at veal, for example. Every one loves beef, and the cow is a decent looking animal, but veal, well, that comes from cute little baby calves, locked up in boxes."

Richardson has theorized that part of the appeal of koala is the natural lifestyle of the creature. Slow and sloth-like to begin with, the koala naturally displays the tender, flavorful properties of good veal. But that's not where it ends. One peculiar aspect of koala life which few people realize is that the koala, famous for its glassy-eyed stare, is almost perpetually drunk from the moment it begins its monothematic diet of eucalyptus leaves. The leaves break down very slowly, and actually ferment in the creatures stomach. "As we all know," muses Richardson, "the best marinades are often ones containing alcoholic flavorings. Anyone who has ever grilled a sausage in beer, or simmered a fine roast of chateaubriand in madiera knows the flavor and texture of well marinated meat. The koala, well the koala comes pre-marinated in his own juices."

Of course this discovery is not without its dissenters. Richardson and group were harassed by radical organizations such as PETA and Greenpeace even before their permit to start grilling began. "The project only truly got under way when the first consumption of koala was documented last year, in the koala's native Australia." A man by the name of Robert Speck apparently became intoxicated, and wandered into the Australian wilderness, where he became lost. Koala was the only thing he could catch. "Some men would be ashamed to say they ate a koala, but Speck is a special breed, and to him I'm forever indebted" says Richardson.

For now, koala farming is impractical, and PETA Furious, but Richardson plans to bring the bear to market as soon as possible. "Some say the koala should be appreciated and loved, not eaten. I say 'Love the koala because you can eat him....and he tastes *good!*'" EF

Photo by Ted Hessing

Preparing to serve the koala meat.

Engineering Wonders of the Modern World,

And the People who Built Them

by Tom Catherwood

As the world progressed farther into the age of steel, concrete and machines so to did the nature of major engineering projects.

The Empire State Building broke the New York skyline in 1931 rising 1453 feet above the city streets. The Hoover Dam, built in a virtually inaccessible canyon, holds back one of the world's largest man-made lakes. Magnificent Cathedrals oversee the European countryside, serving not only as a testament to religion but also as a shrine to the ingenuity of mankind. The Panama Canal, the Suez Canal and the Great Wall of China! Skyscrapers, dams, and bridges. Throughout the world engineering projects have changed the land, the sea, and the sky. This article is not only about the engineering projects that have changed our world. It's not about the fact that the Great Wall is the only manmade object viewable from space. It's certainly not about the fact that the Hoover Dam is large enough to bury Virginia Tech's football field under 1476 feet of concrete. This article is about the people that riveted beams at the top of the Empire State Building. It's about the masons that finished the arches, ceilings and towers on 12th century Cathedrals. It's about the safety practices, or lack thereof, that allowed for the engineering wonders of our modern world.

Today safety in the workplace is a national issue. OSHA, the Occupational Safety and Health Administration, has regulations on everything from fall protection and fire safety to ergonomics and techniques for lifting heavy boxes. What was safety like on major engineering projects 50 years ago? 100 years ago? 300 years ago? Were early Cathedral foremen fined for noncompliance with ergonomics regulations?

The answer: They might have been, if there was a foreman to fine. Cathedrals took decades to build, so workers could literally spend the better part of their lives on one project. Suspended more than a hundred feet in the air on questionable scaffolding with rope was the only means of fall protection, workers faced a myriad of hazards. Masons hung from the walls and buttresses on tethers and swings mortaring the building together. Gigantic stone blocks were hoisted in place by a series of pulleys. In fact, the only thing holding most Cathedrals together was, and still is, mortar and metal bracing. Yet, the Cathedrals still stand today. Some are even a thousand years old or more. If Medieval Cathedrals can outlast clans, dynasties, and civilizations, will the super structures of today stand a similar test of time?

"Yeah, and if you believe that, I've got a bridge to sell you..." Not just any bridge, but the Brooklyn Bridge. The bridge spans 5989 feet and its two towers are 273 feet tall. Not much by modern standards, except that this cultural and national landmark is 117 years old! The Brooklyn Bridge is so old that it was one of the first structures in America to rely on steel as a load bearing material; iron was the material of choice at the time.

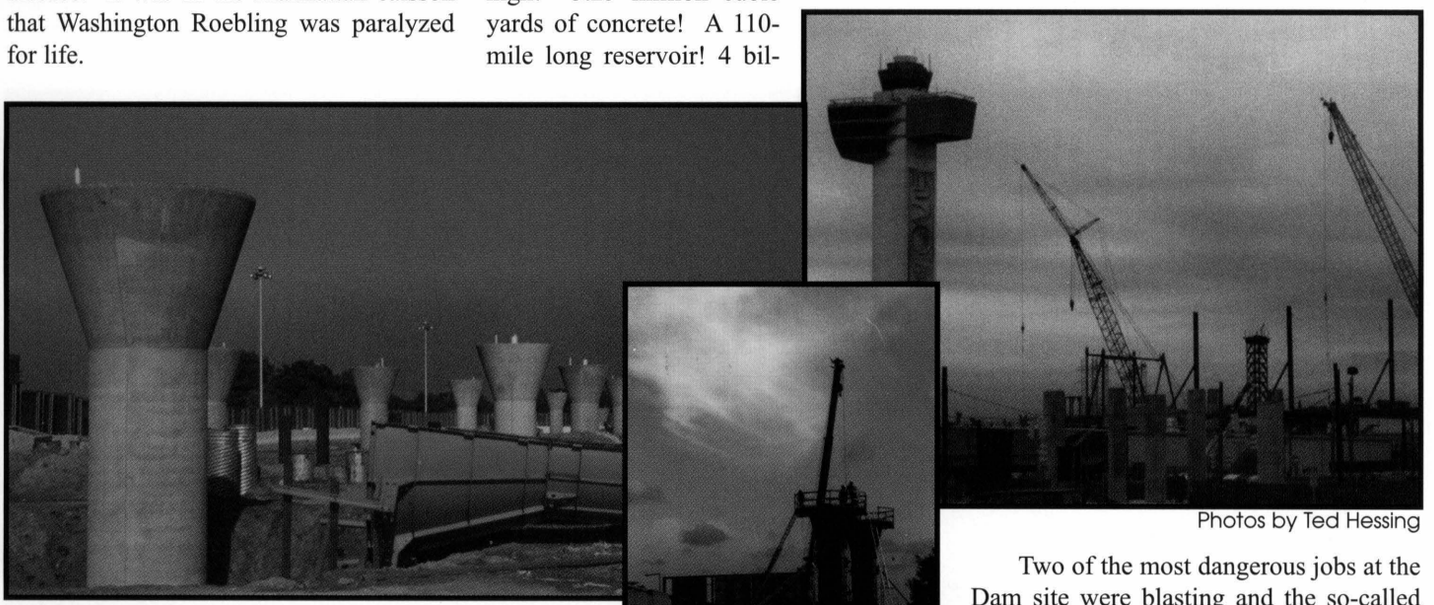
Construction of the bridge began in 1869 and took 14 years to complete. Over the course of these 14 years, a reported 27 workers lost their lives and countless others suffered physical injury or permanent paralysis. With no safety nets to catch falling workers and 50 years before hard hats became standard issue, safety at the work site was minimal. Falling from the bridge, falling equipment, crushing by construction blocks and caisson disease were the most common dangers on the site. Caisson disease, now referred to as the bends, killed three workers and left numerous others paralyzed. Even the Chief Engineer, Washington Roebling, suffered permanent paralysis from ascending too quickly through the compressed air environment of the caisson.

The caissons were hollow tubes dug into the bed of the East River. Workers excavated the alluvial river mud to give the bridge towers a firm footing on bedrock. As the caissons were dug deeper, the pressure inside the tubes mounted. With increased pressure, more atmospheric nitrogen can dissolve in the blood. If a person moves from an area of high to low pressure too quickly, the nitrogen can "Bubble," thereby blocking veins, arteries and blood flow. Permanent paralysis and death are the possible effects of "Caisson disease". The Manhattan caisson in partic-

ular was dug far deeper than its Brooklyn counterpart. Therefore, the Manhattan caisson had more frequent bouts of caisson disease. It was in the Manhattan caisson that Washington Roebling was paralyzed for life.

Arizona and Nevada, and created a masterpiece that no picture can capture and no words can rightfully describe. 726.4 feet high! 3.25 million cubic yards of concrete! A 110-mile long reservoir! 4 billion kilowatt-hours of energy produced yearly by its generators! The Hoover Dam is simply amazing, but its construction was simply

equipment, and truck accidents were just a few of the hazards faced by Dam workers on a daily basis.



Photos by Ted Hessing

Some construction sites at JFK International Airport.

Working in the compressed air of the caisson, or at the peak of a mid-span tower was dangerous on the Brooklyn Bridge. However, it took a truly fearless individual to work construction on the Hoover Dam. Built in the four years between 1931 and 1935, the Hoover Dam is one of the modern engineering world's true wonders. Workers started with a lump of clay in the form of an inaccessible canyon between

Two of the most dangerous jobs at the Dam site were blasting and the so-called "High-Scalers". Blasting consisted of removing rock with dynamite. Workers' safety was compromised by both the dynamite and flying shards of rock. High-Scalers were men that hung from the canyon walls on body harnesses and removed loose rock prior to the pouring of the structure. The scalers faced immense danger carrying nothing but tools, water and a 44-pound jackhammer. Besides the inherent danger of hanging off of a cliff on a glorified swing, high-scalers had to deal

If Medieval Cathedrals can outlast clans, dynasties, and civilizations, will the super structures of today stand a similar test of time?

deadly. Estimates put worker fatalities at anywhere from 96 to 112 workers. Drowning, blasting, falling rocks and

with live air hoses, electrical lines and bundles of steel hanging from the canyon walls.

The onsite hazards of working at the Hoover Dam led to a makeshift safety device called the 'Hard-boiled hat". The risk of death or injury from falling rocks and tools was so high that workers coated cloth hats with coal tar for an added layer of head protection. These tar-covered hats worked so well that the general contractor made them standard issue safety devices on the dam project. Today the coal tar has given way to molded plastic, but the idea behind the modern "Hard-hat" remains the same as its tar derived ancestor some 70 years ago.

As the Hoover Dam filled Black Canyon in Arizona, construction workers across the country were attempting to redefine the term skyline. The Empire State Building in New York, 102 floors of architectural and engineering ingenuity, was the largest building of its time and is currently the 5th tallest building in the world.

Besides its early dominance of the New York City skyline and its prominent place in American culture today, construction of the Empire State Building was an awe-inspiring feat in and of itself. Unlike the 5 years it took to build the Hover Dam, or the 14 for the Brooklyn Bridge, the Empire State Building only took one year and 45 days to complete. That means the building rose an average of 4 stories a week!

On the Empire State Building, workers dealt with standard construction hazards like falling tools, blasting, and falls. The added height of the building also exposed workers to high winds. A documentary on the History Channel reported that workers at the top of the building were routinely stung by kernels of grain picked up by winds in the Midwest and carried all the way to New York. Yet, even with the added variable of height, only five workers died during the building's construction!

Before the construction of the Empire State Building, there was typically one death for every million dollars spent on major engineering projects. The total cost of the Empire State Building was roughly 41 million dollars, debunking the past death/cost standard. The low death toll was due to numerous safety precautions. There was an on site hospital staffed with a nurse on full time duty and a physician on call for serious injuries. Furthermore, a street side entrance was kept free at all times for ambulances.

As the world progressed farther into the age of steel, concrete and machines, so to did the nature of major engineering projects. The Sears Tower, World Trade Center, and most recently Petronas Towers in Malaysia all pushed the skyline above and beyond anyone's expectations. A proposed skyscraper in Chicago is employing new technology and design in the quest to reach 2000 feet. Major dam projects in Brazil and China are providing power for growing populations and economies. Even the "Big Dig" in Boston, which is attempting to divert mass amounts of traffic around and under the city instead of through it, is an amazing undertaking in today's world. A world where engineering begins with the dreams born of our wildest imaginations, and ends with fully functioning physical landmarks. Just remember, it's all thanks to the people that riveted bolts in gale force winds 1400 feet above New York City, the workers that died or were paralyzed as they attempted to unite Brooklyn and Manhattan, and the men who dedicated their lives and livelihoods to building the Cathedrals. So to the masons, the high-scalers, the crane operators… to the excavators, the day laborers, and the concrete mixers… to every person that worked to make castles in the sky and build foundations under them… thank you EF

Photo by Tom Catherwood

235 ft. above the streets of Washington, D.C. No fall protection except a rope and wooden scaffolding. Would you have worked at the pinnacle of the National Cathedral.

A world where engineering begins with the dreams born of our wildest imaginations, and ends with fully functioning physical landmarks.

Photo by Ted Hessing

FROM THE

email bag

forum@vt.edu

The Balloonist

A man is flying a hot air balloon and realizes he is lost. He reduces height and spots a man down below. He lowers the balloon further and shouts, "Excuse me. Can you help me? I promised my friend I would meet him half an hour ago, but I don't know where I am. Can you tell me?"
The man below says,
"Yes, You are in a hot air balloon, hovering approximately 30 feet above this field. You are between 40 and 42 degrees N. Latitude, and between 58 and 60 degrees W. longitude".
"You must be an engineer," says the balloonist.
"I am," replies the man. "How did you know?"
"Well," says the balloonist, "everything you have told me is technically correct, but I have no idea what to make of your information, and the fact is I am still lost."
The man below says, "You must be a manager."
"I am," replies the balloonist, "but how did you know?"
"Well," says the man below, "you don't know where you are, or where you are going, You have made a promise which you have no idea how to keep, and you expect me to solve your problem. The fact is you are in exactly the same position you were in before we met, but now it is somehow my fault."

Comprehending Engineers - Take Nine

An engineer was crossing a road one day when a frog called out to him and said, "If you kiss me, I'll turn into a beautiful princess." He bent over, picked up the frog and put it in his pocket.
The frog spoke up again and said, "If you kiss me and turn me back into a beautiful princess, I will stay with you for one week." The engineer took the frog out of his pocket, smiled at it and returned it to the pocket.
The frog then cried out, "If you kiss me and turn me back into a princess, I'll stay with you and do ANYTHING you want." Again the engineer took the frog out, smiled at it and put it back into his pocket.
Finally, the frog asked, "What is the matter? I've told you I'm a beautiful princess, that I'll stay with you for a week and do anything you want. Why won't you kiss me?"
The engineer said, "Look I'm an engineer. I don't have time for a girlfriend, but a talking frog, now that's cool.

letter from the
editor

More Engineering Than You Can Handle

by Tom Catherwood

This is my first letter as Editor of the *Engineers' Forum* and I don't know exactly where to start. Typically these letters explore meaningful question about engineering here at Virginia Tech. One letter considered the possible ramifications of our overuse of technology - yes, I use my calculator for simple subtraction. There was even a letter searching for the practicality and real world application of our classes. Clearly I should come up with some witty and insightful take on a subject that affects every engineer's life. How about classes? How about the core curriculum? How about the fact that the physics book is only slightly more competent than the teachers? Or how about the fact that in a few short weeks, this year will be over? There will be another class of freshman coming in to remind us exactly how old we're getting. In fact, this magazine goes out to all incoming engineering freshman. Maybe we should give them a little introduction to their first year?

Incoming freshmen, welcome to Virginia Tech. If it's the summer and you're reading this it means you've chosen to come to the great town of Blacksburg 24060 to study engineering. Congratulations! Engineering is spectacular here at Tech. However, when you first arrive you are going to hear some horror stories, and let me be the first to say that they are not true. For example, Engineering Fundamentals. You'll hear that it's impossible, overwhelming and uncontrollable. Don't worry, it's not that bad. At least not until you get to class. The tests are easy… if you were born with a TI-89 in your hand. And the book is fabulous… as kindling. But it's okay, because if everything goes according to plan 40% of you will become business majors after the first semester. Not really. Some of that 40% will retake Engineering Fundamentals before becoming business majors.

Those of you that do make it through EF (a catchy moniker for Extra Fun), congratulations. You will be well on your way to one of the most rewarding, fruitful and challenging majors around. Besides EF, engineering students are pampered with some of the best facilities imaginable. The Math Emporium, our state of the art computer center complete with all the comfort and coziness of a hurricane shelter, serves all of your computing needs. There is also a requirement that all freshman own a computer thereby defeating the need for the Emporium but don't worry about that.

There is no reason to dwell solely on the fabulous Math Crematorium when other excellent places are open for the advancement of student learning. You want cutting edge? Look no further than the physics and chemistry labs. Bunsen burners, pipettes, carts on "frictionless" air tracks and other World War II surplus items are available for your use. The possibilities for practical applications are so astounding (read: miniscule) that if you actually learn something, come, please tell me: we'll publish it.

Engineering isn't all just classroom learning. It's important to get a sense of the correlation between what we learn and how it all works in the real world. Just walk around campus, there's a wealth of knowledge waiting for you. You'll learn that replacing grass with concrete saves on mowing costs. Every Engineer knows that the best way to remedy the eyesore of an open field is another building or two.

Above and beyond work, studying and learning, engineering slowly becomes a way of life. We learn important critical thinking skills. We learn to observe and analyze the world in different ways. We learn that without engineers, and healthy applications of duct tape, the world would cease to function. Someday you will laugh at a "You might be an engineer if…" joke. Someday, you might think a brown belt matches a black pair of shoes. Someday you will wear a short sleeve shirt with a tie - this doesn't necessarily go for the women, as guys seem to be the only ones afflicted with this style. Someday you will keep more than two pens, and possibly a straight edge, in your shirt pocket. Someday maybe, just maybe, with hard work, dedication, and a general lack of sleep you might find that you have become an engineer... if you don't get lost at the Math Emporium first.

To all Virginia Tech Students: Good Luck on your Final Exams
To all incoming Freshmen: Good Luck on everything.

Go Hokies,

Tom Catherwood

Tom Catherwood

Engineer's Forum Join it.

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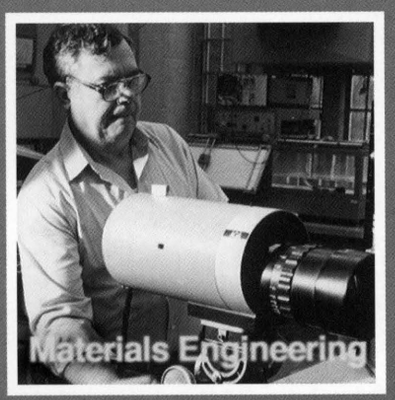

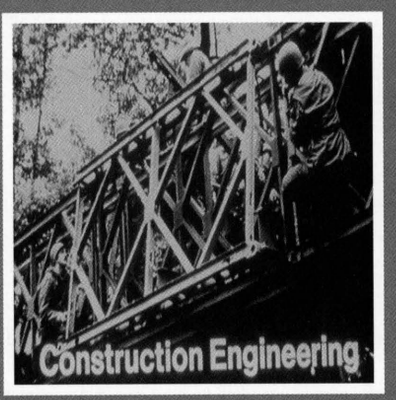

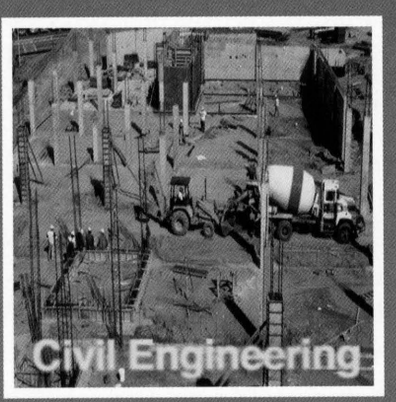

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come to the meetings Mondays 5pm in Norris 333 or email us at forum@vt.edu

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