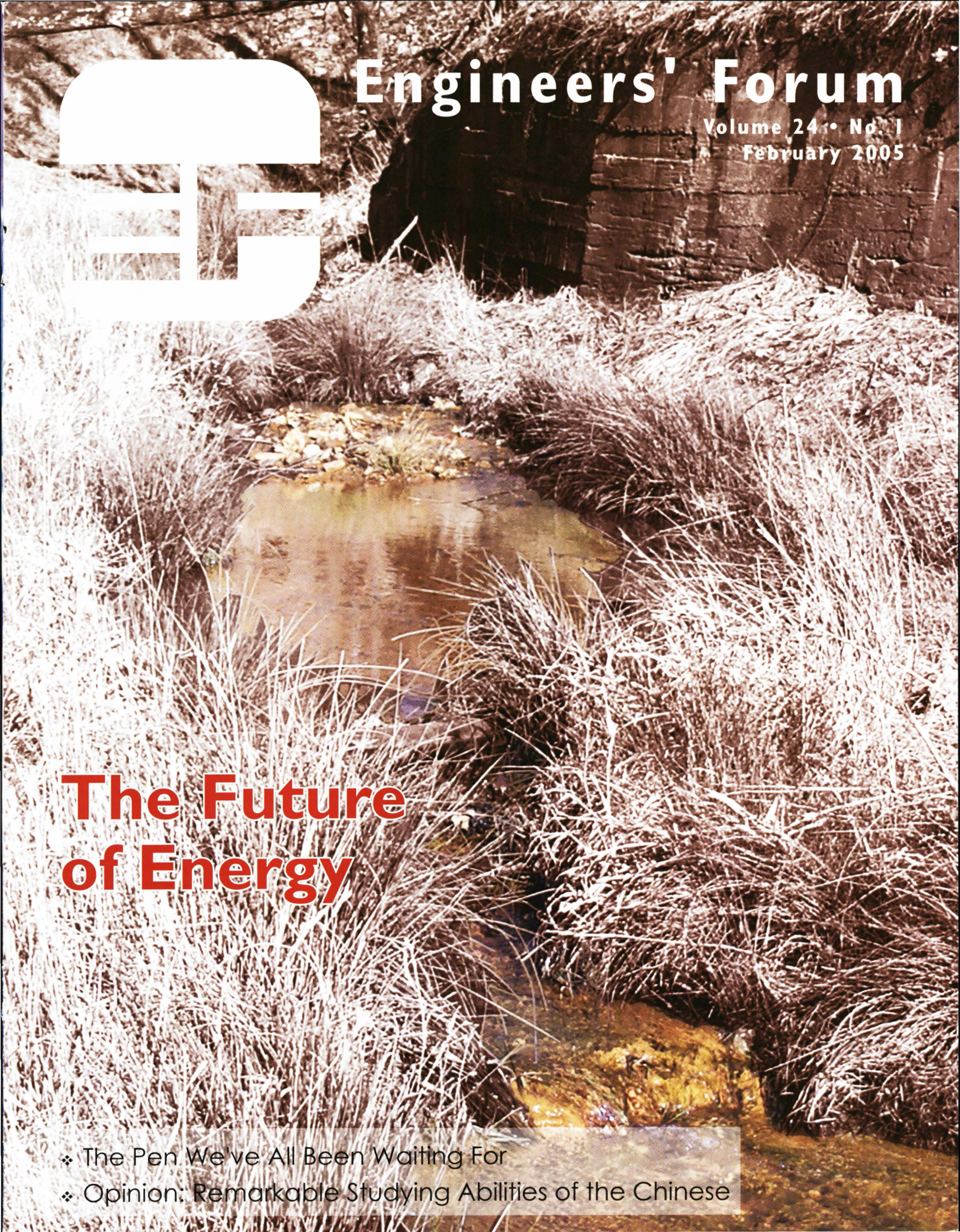


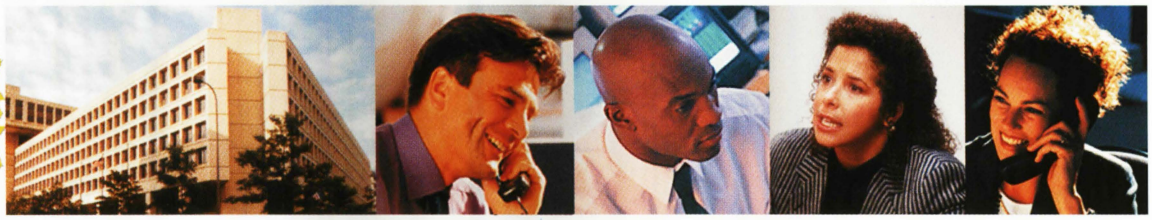
Engineers' Forum

Volume 24 • No. 1
February 2005

The Future of Energy

- The Pen We've All Been Waiting For
- Opinion: Remarkable Studying Abilities of the Chinese

FIDELITY. BRAVERY. INTEGRITY.



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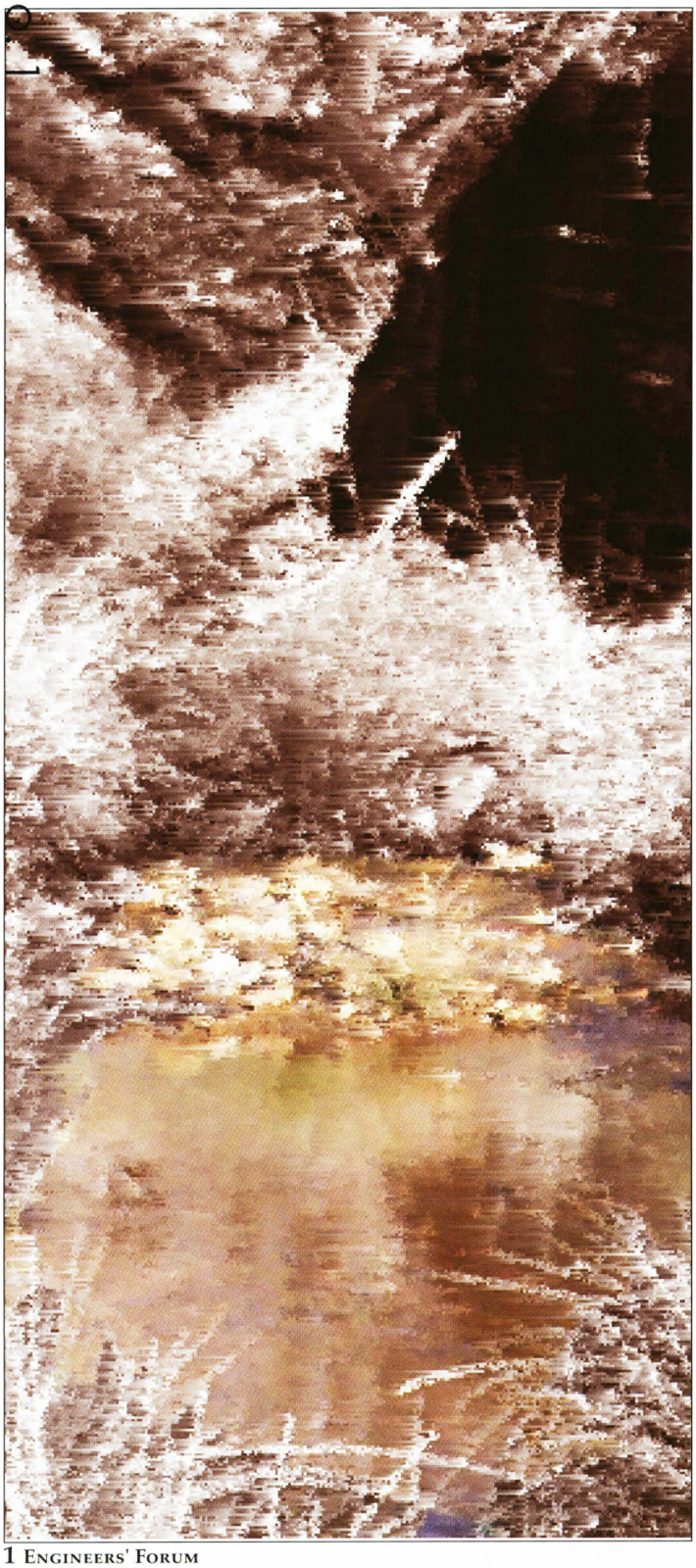
inside



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FROM THE EDITOR

Welcome to a new year and a new semester. I have decided to use this issue's column to do some shameless self-promotion. We are always in need of talented writers, designers, photographers, business men and women, and anyone else who is interested in engineering, technology, school events, journalism, publishing, business, or leadership. No prior experience is necessary. Any major is welcome!

Before I got involved in the *Engineers' Forum* I had never worked on any sort of publishing or journalism before and only started coming because I was coerced by a friend. To her I am very grateful, I have enjoyed this experience immensely and it has helped me decide what the best path for me is. I changed my major from Aerospace Engineering to Biology and English (Professional Writing) because I am still very interested in science, but what I want to do is write about it.

Especially now, since Landon Fraser (our primary Photographer) and Enoch Dames are both graduating at the end of this semester, and Mary and I are both graduating at the end of the coming fall semester. We need new additions to the staff with fresh ideas. It also looks great on your résumé, and it is a great way to build up your portfolio and get published or to even discuss your own research and projects. Also, for all of you business-minded people (*cough* ISE *cough*), we run the magazine ourselves and need someone to work with the business aspect of the process.

This magazine is a voice of VT Engineering Students. Help it be the best it can be! If you would like more information or submit to an idea or comment, please email me at forum@vt.edu. We meet at 5:15pm every Thursday, in 333 Norris Hall.

I hope everyone has a wonderful semester!

Sarah Lewis
Executive Editor

Move over Supercomputer!

By Sarah Lewis

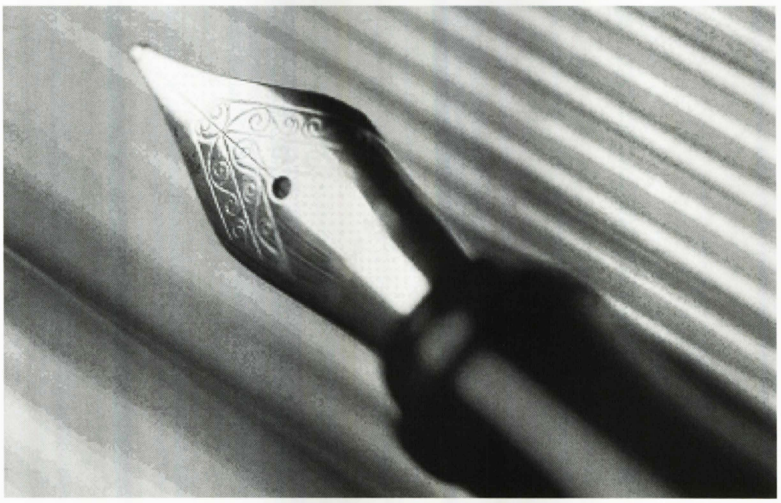
Who needs a supercomputer to do their homework for them? Almost every kid in America, at one point or another, had the assignment to come up with an invention for class. I also will bet that at least 75% of those kids made up a pen that could do your homework for you. I know I did. I mean, who didn't want a pen that would do addition and multiplication for you? I know I went to all the trouble of coming up with a completely improbably design that resembled Leonardo da Vinci's inventions with gears and strings, and other features.

Kids of America, your dream has come true! LeapFrog Enterprises Inc. is unveiling one of its newest learning tools, a digital pen with handwriting recognition and sound technology that can then compute simple mathematical equations, spelling questions, play music on a drawn piano keyboard, and even translation to French or Spanish.

According to Stephanie Kang in an article for the *Wallstreet Journal*, LeapFrog's Mr. Marggraff, of LeapFrog Inc., envisioned this product after reading a story in *Wired* magazine about Anoto AB handwriting recognition pen technology. He envisioned a pen that would incorporate Anoto AB's handwriting recognition technology and LeapFrog's sound technology to make an innovative and educational toy for children elementary school-aged through middle school. The FLY is scheduled to be on the shelves of Wal-Mart and Target by fall 2005 for $99.00. Its technology is based on, Anoto AB's (LeapFrog's partner in this project) handwriting recognition pen that was released for the business world prior to 2000.

Handwriting recognition technology has been around for quite a while. The idea of it was actually around prior to 1980, according to Conrad Blickenstorfer, in an article for *Pen Computing* magazine (April 2000). This technology is used in many applications today including popular PDAs. Along with IPODs and Cell Phones, it is easy to see many Tech students using Palm Pilots and other PDA brands to play games, keep track of assignments and meetings, and often even check email.

What makes LeapFrog's and Anoto AB's technology different is that the recognition takes place in a special kind of paper. According to the article in *Wired*'s April 2001 edition, written by Steve Silberman, which inspired Mr. Marggraff, in Lund, Sweden Anoto is creating a special paper that is cheap and easy to produce, as well as a special pen to go with it, and it will work in a similar way the screen of a Palm Pilot works for handwriting recognition. According to this article, "By the end of the year [2001], Ericsson will bring to market a pudgy-looking ballpoint called the Chatpen. It will be the first of a new breed of writing instrument invented by Anoto that will allow you to send email and faxes directly on paper, with no personal computer or wireless tablet in sight....A single scribbled note will trigger a cascade of networked events: Jotting down a lunch date in you day planner could update your laptop and fire off an email to your assistant."



Digital pen by LeapFrog Enterprises Inc. has handwriting recognition and can compute simple mathematical equations.

The secret behind this pen's technology is the paper. According to *Wired* magazine, Anoto created "digital paper" that costs about the same as "standard copy stock." At the bottom of each pen is a tiny camera that recognizes what is under the pen. This is the same principle behind the small autonomous vehicle senior Tech engineering students work on every year. The difference is the camera on the pen picks up the near-invisible infrared waves that the ink dots reflect instead of the ink the user sees.

According to the *Wired* article, "The Anoto pen does not understand language. With certain exceptions, the pen doesn't perform OCR (optical character recognition) on what you've written..." In this case, the LeapFrog/Anoto FLY is quite an improvement because the FLY contains a database of "70,000 words" and can translate

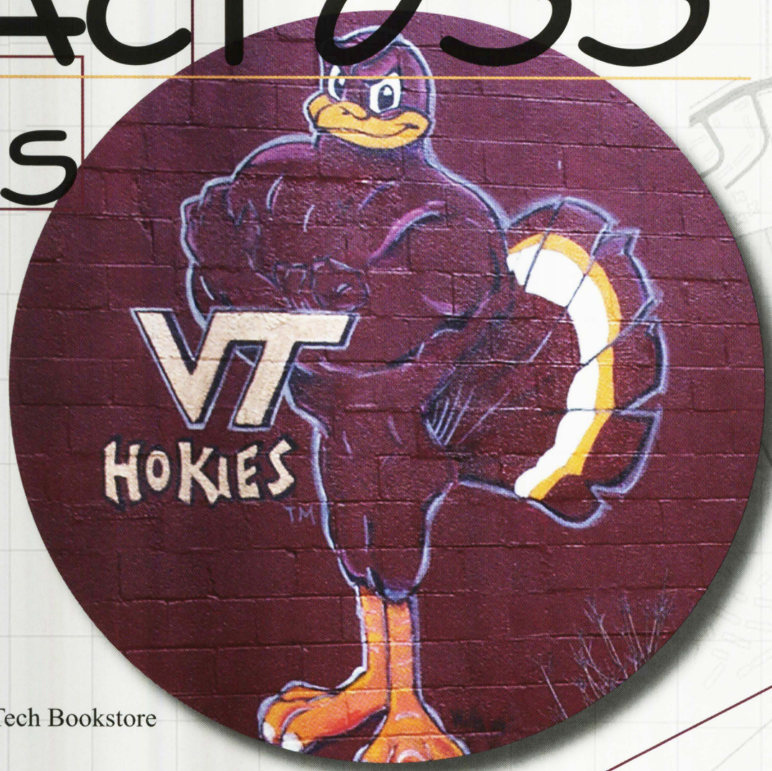
those words into Spanish and French, according to the *Wallstreet Journal* article, in January 2005. What makes Anoto technology different from the rest of the computer industry is that it does not need a computer, only a "Bluetooth device within 30ft, which could be your mobile phone or PDA."

My prediction is that the FLY will be extremely popular in elementary and possibly middle schools, but will quickly become banned from classrooms and end up in the infamous "June Box." To learn multiplication and addition, you have to do it. It will probably be treated much the same as a calculator. While the new LeapFrog pen might be targeted towards a younger audience than the typical college student, it does provide a cheap method to take digital notes for grade-schoolers.

I might actually be tempted to check out this new contraption in the fall. There are many varieties on the market now geared more towards the business world. Logitech has a version available now called the Logitech io2 Digital Writing System. I just might be tempted to go check it out for myself soon. I would be able to transfer my notes to the computer without re-typing or scanning them.

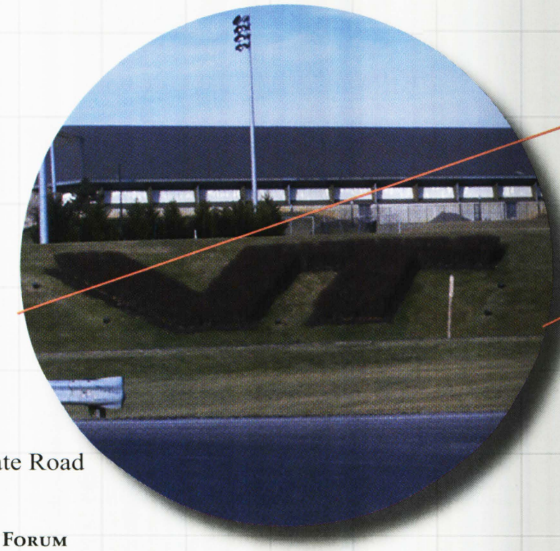
VT's Across Campus

PHOTOS BY LANDON FRASER



Tech Bookstore

Lane Hall



Southgate Road

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source of map: http://www.unirel.vt.edu/map/Webmap2004.pdf

Virginia Tech Energy – A Hopeful Outlook for a Sustainable Future

By Enoch Dames

Virginia Tech is one of a very few universities that generate a portion of its campus energy needs. We are also unique in that our arms are stretched across the entirety of environmental academia. With the ever-prevalent need for sustainable energy practices gaining more attention, Virginia Tech strives to become a leader in these fields.

The Virginia Tech power plant has been around since the beginning of the twentieth century. It has been constantly upgraded throughout the years to serve continually increasing energy needs. Soon, it will be time to make yet another upgrade, but there's a strong possibility that we will install a biomass-fueled power plant.

I spoke with Ben Myers, Utilities Director for Virginia Tech, to gain a better understanding of the current VT power plant. Myers has a lot on his shoulders; he is responsible for operations in the power plant, underground utilities, and VT electric service.

Q Can you first tell me a little about the power plant?

A The powerhouse is rated at 6.25 megawatts, a pretty small amount of energy. There are five boilers. Two of them are coal-fired; they generate about 100,000 lbs (of steam) per hour each. That's what they're rated at. Boiler 7 is the oldest coal fired unit that we have. Boiler 11 is the newest one; it has a gas scrubber attached to it, and it also has a baghouse (components that clean the coal exhaust to a certain degree). We are soon to build a baghouse and scrubber for boiler 7 to bring it into today's emissions compliance. We've got three smaller ones (boilers 8, 9 and 10); they are rated at 60,000 lbs per hour each. They use fuel or natural gas.

Q How does the power plant serve Tech's energy needs?

A It provides steam heat to the majority of the buildings. It exhausts steam out at 15-psi, and we also have a high-pressure 90-psi steam system as well. So, some of the buildings will use 90-psi steam, others will use 15-psi steam. Some of the buildings have hot water converters; they use the steam to heat water. Some of the labs utilize the steam, so does dining services, and the dorms are supplied with hot water. It provides a lot of the campus with the steam and heat energy it needs.

Q I hear there's talk of building a new power plant, as our campus is growing. What can you tell me about this?

A We do have a Request for Proposal out there, and as a matter of fact, I have about 15 responses on my desk right now from it. We are going to conduct a study basically to look at the southwest side of campus. All the growth of the campus is happening away from the powerhouse. So, a problem could be designing a system to distribute the steam to the other side of campus. We are going to take a long hard look at that situation to try to determine what the best solution for the future would be.

Q How long do you think it would take to build this new power plant?

A I would anticipate about three to four years, but it really depends on a lot of factors. However, we're reaching the limits of the current distribution system.

Q Wilson Prichett, the campus energy manager, hopes that the new power plant will use biomass to generate energy. What are you thoughts on this, and it's feasibility?

A It's what I'm looking for the study to tell me. If biomass was

the answer, and everything fit into place, then why would we spend money on the study? I want the study to tell me what the answer is. I don't want to rule it in; I don't want to rule it out.

Q Do the current boilers ever break down?

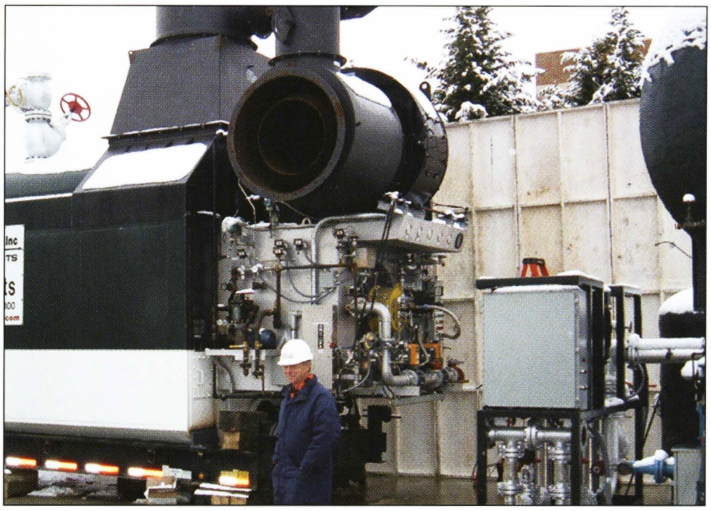
A I wouldn't tell you . . . just kidding. It's just like any piece of mechanical equipment, you know. Something's going to wear and you're going to have to change it out or whatever the case may be. The coal-fired boilers only operate, roughly, October to May. They don't operate during the summer months. This allows us to make repairs. It's an ongoing thing.

Before I spoke with Ben Myers, I really didn't know much about the power plant, or to what extent our school utilized it. I suspect most of you share my lack of knowledge. So, Mr. Myers enthusiastically invites all of you to take a tour of the power plant. Classes and other groups have done this in the past, and the people at the power plant are always willing to educate Tech students about how things operate over there.

The Future of Energy at Virginia Tech

Some of you may be aware that our school has gradually become more involved in a battery of environmental issues, such as green engineering, renewable energy practices, and environmental policy and management.

The *Virginia Tech News* recently published an article concerning coal-cleaning technologies developed by faculty in the Mining and Mineral Engineering department. Their technologies allow for water and many mineral impurities to be separated from coal waste, producing clean, combustible coal. Many coal waste "ponds" exist throughout the United States, and one mining company is currently using the technologies developed to the produce clean coal from these ponds. Although these types of technologies are critical to the efficient use of coal in the future, coal burning is not the only answer, nor is it always the best answer.



Ben Myers, Utilities Director, next to Tech's power plant.

The coal we use was created over millions of years from prehistoric organic matter. Every time we burn it, we introduce ancient and unwanted greenhouse gases into the atmosphere. High concentrations of these gases just don't mix well with most ecological systems on this planet. I point you in the direction of the library in case you want to know more.

Wilson Prichett, the Virginia Tech energy manager and a renewable energy advocate, likes to make the point that the greenhouse gases released from burning biomass is more desirable than burning coal. Why? The answer is that plants in nature inevitably decompose into methane (CH_4), carbon dioxide (CO_2), and carbon monoxide (CO). If we filter biomass-fired emissions with the same stringent standards imposed at our current power plant, we will not alter the already dangerous conditions induced from fossil fuel combustion.

Virginia Tech's Next Power Plant

Returning to the issue a potentially new power plant raises - does it have to be coal-generated energy? Wilson Prichett says no.

"Of the renewable resources, the list includes geothermal, solar, wind, and hydroelectric power. Wind is difficult to collect and sporadic, and geothermal is very limited around here. There are also only streams nearby. So, what are you left with? Biomass. The renewable energy answer for Blacksburg is biomass"

Biomass, in a nutshell, is exactly what its prefix suggests it to be, biological matter. The most commonly used forms for combustion-generated energy are wood scraps, solid wastes, even sewage sludge. Thankfully, there's a heck of a lot of biomass around here, but don't take my word for it.

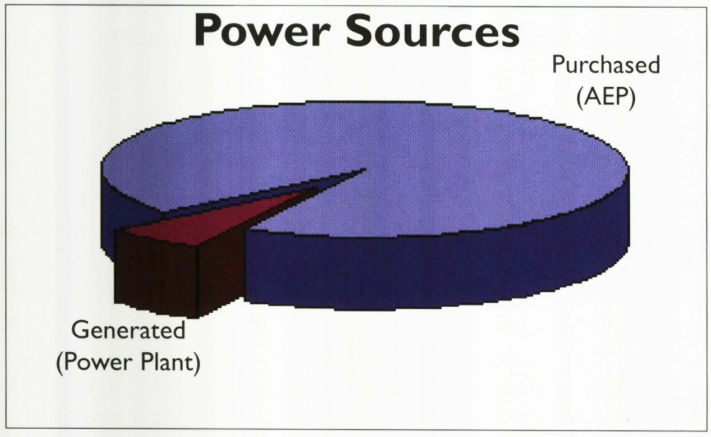
"We have a heck of a lot of biomass around here. We can get people to pay us to take biomass from them"

That's a hard deal to beat, considering that we buy very high quality coal all the way from Kentucky. Oil and fuel both exceed the price of coal by multiple times. And, if we need to build a new power plant anyway, shouldn't we make best decision, one that would benefit us on all fronts?

A biomass-fired power plant has many of the same components as a coal-fired one. The main differences are in the size of the firebox and the amount of air needed to fuel the fire. The exhaust produced would be filtered similarly to current coal exhaust filtering methods. The drawback, however, is that a biomass plant requires about 100% more mass than a coal-fired one to generate an equal amount of energy.

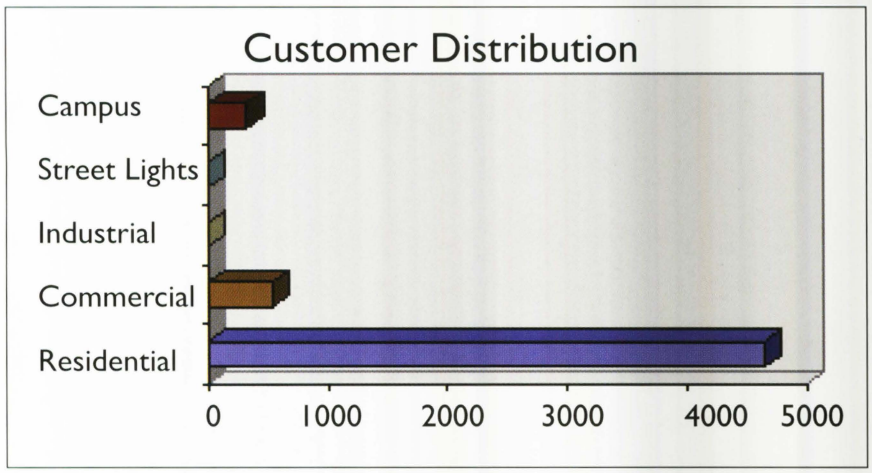
It is common for those in the long-standing industrial businesses to even dislike the "green" focus. Once industrial standards have been set, it is very easy to be skeptical of a novel process that could benefit everybody. It seems that change scares some people. Prichett is not intimidated though; he knows what he's doing.

"We're in the business of supplying heat, power, and hot water.



This is not research here. When I recommend something, it darn well better work. It can't be a research project. I started this stuff in 1969. I've built wind generators, geothermal generators, biomass generators, hydro turbines, and have worked on countless energy conservation projects."

Now that global warming has been acknowledged by growing numbers of the general populace, renewable energy is gaining more attention. Depending on how much damage we've already done to the atmosphere, utilizing renewable energy may not even be an option in the future. So, why not start now? Prichett hopes to have something in the design stage for the new power plant by 2007.



In order to meet the campus's increased energy needs, a temporary oil-fired boiler was installed in the power plant. This boiler is scheduled to remain operable until the new power plant is constructed.

In many ways, Virginia Tech is paving the way to become a leader in green engineering and energy conservation. We're at the front line on all fronts. Or, as Prichett liked to put it, "We're trying to really do something here."

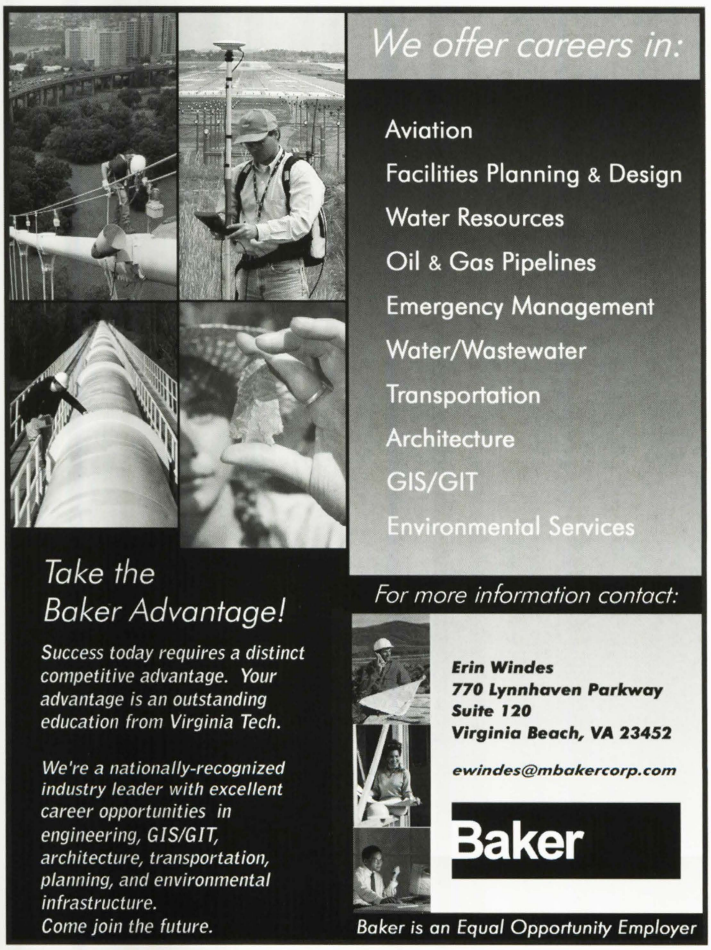
Get Involved For those interested in getting involved with environmental issues and renewable energy practices on campus, here are a couple of the clubs and committees currently active:

- Campus Energy Watch – a universities consortium on energy restructuring and the promotion of sensible energy choices

- ACES – the Advisory Council for Environmental Sustainability, a newly formed council designed to create an interdepartmental voice guiding the development of sustainable living in Blacksburg

- The Environmental Coalition – A multi-student group force of over 800 members working towards the common goal of increasing sustainable practices at Virginia Tech. Send inquires to ec@vt.edu.

Learn More For a myriad of information concerning renewable energy in general and development of new technologies that will feed the energy needs of the future, go to this website run by the National Renewable Energy Laboratory - www.nrel.gov.



The Cultural-Evolutional Development of the Remarkable Studying Abilities of the Chinese

By Enoch Dames

This story was related to me by a venerable friend of mine; it's only a story, so I make no claims to it validity. Classically, what follows does not represent the views of the Engineers' Forum or its staff – it's just me.

Nestled in the middle of nowhere, USA, Virginia Tech attracts a large foreign population. It is mainly in the engineering and science disciplines that these outsourced minds are focused on. Now, why would I use such a word as "outsourced"? It has everything to do with a trend of declining intelligence among Americans. As to why this has *happened*, I won't get into. However, Virginia Tech strives for academic excellence, and many hard-working foreign students help to maintain the high standards set by Tech. Although it is the United States that holds the world's best universities, many brilliant students enrolled in them come from all over the globe.

Some Americans think that those from countries such as China and India are innately smarter than others. It is definitely a generalization, accepted or not. I agree with most people when I say that this generalization is probably not true. Still, you've heard it said before. Although the Indians have a similar story, which lead to their impeccable memories, I can only confidently relate the story of *The Cultural-Evolutional Development of the Remarkable Studying Abilities of the Chinese*.

The Chinese have been around for a long, long time. Their history is rich and filled with monks that could fly and Taoist priests that could change into fish. The development of their remarkably efficient studying habits stretches back to the days of the dynasties, a couple of thousand years ago. During these times, societal honor was given to those who became scholars. In this respect, the Chinese were the first to form such a system of education, and placed much importance on starting early in life. Many young men dedicated their early lives to 'the study.' Periodically, the ruling emperor would give an exam. Those who passed this extremely difficult exam were deemed scholars; they represented the top 1E-10% of the general male populace (even though that's just a fraction of one person). Many scholars were automatically given positions such as the governor of a town, or a position in policy making. But, the most honored position was 'Scholarly Advisor to the Emperor.'

Emperors could never acquire the knowledge or intellectual confidence scholars held. Emperors waged wars, suppressed uprisings, and defended themselves from the Mongols. They spent time with concubines. Some of the emperors were even children with little experience in every discipline. So, each emperor had a team of scholars, or advisors, to help in the decision making processes. It was these scholars that ultimately ruled the land, and the emperor was always aware of this. But, scholars were expendable for every able male wished to be one. With any inclination of ulterior motives, the scholar was as good as dead, maybe even dead. There were always more scholars to come by and a new one would be chosen to aid the emperor.

Thus, century after century, the Chinese began to develop amazing study habits. They've unconsciously developed super-efficient learning capabilities, which enable them to perform better irrespective of their goals, or so the story goes.

"This is not the age of pamphleteers. It is the age of engineers. The spark-gap is mightier than the pen. Democracy will not be salvaged by men who talk fluently, debate forecefully and quote aptly."

-Lancelot Hogben
Science of the Citizen

EF Challenge

It's like trying to find a slide rule on and Engineering Campus!

Your challenge, should you choose to accept it, is to locate the slide rule somewhere in this magazine. It may be hidden anywhere:

- A photograph
- An illustration
- Anywhere we could deviously think of to hide it.

When you locate it, send an email to forum@vt.edu with your:

- Name
- Major
- Year
- Email address
- Where you found the slide rule

All submissions should be sent by Friday, April 1, 2005. The winner will be notified by Friday, April 8, 2005.

Previous Winners

The staff of the *Engineers' Forum* would like to say thank you to everyone who submitted an answer to our Where in VT and our Slide rule Challenge contests. We would like to congratulate **Jennifer Zinck**, a senior Civil Engineering student, who won both contests by a random drawing of eligible answers. For the Where in VT contest she won a $40.00 gift certificate donated by the Christiansburg Outback Steakhouse. Also, for the slide rule challenge she won a box of jelly beans from the VT bookstore. What will the next prize be? Enter to find out!

Correct Answers to last issue's contests

- The slide rule was on page 9 aligned with the microprobe.
- The Where in VT locations are:

1. Ag Quad cowgoyle
2. Ag Quad
3. Femoyer Hall anchor
4. Burchard Hall roof
5. Burrus Hall
6. Drill field Drain
7. Duck pond Grotto
8. Lane Stadium sign
9. VT Power plant
10. Price Hall stairs
11. Trees by Slusher Tower
12. VT bush in front of Torgerson Bridge
13. Side of Cassel Coliseum
14. Wind Tunnel

The Importance of Experimentation in Science

By B.J. Ros, Ind. Phys. '49

First Place Winner, Tau Beta Pi Essay Contest

From the April, 1949 issue of The Virginia Tech Engineer

It is a remarkable, historical fact that one of the greatest philosophers of all time should have been responsible for delaying the progress of science for nearly two thousand years. Aristotle taught mankind how to reason about natural phenomena; he showed how to make pertinent observations and deduce results. Before the time of this great Greek philosopher an explanation for a natural occurrence was metaphysical phantasy. Aristotle applied the logic of deduction and analysis to the problem and produced an answer which appealed to reason.

The serious blot on the record of Aristotle's vast contribution to man's ability to reason is that many of his answers were the wrong ones. So great was the prestige of the philosopher that the wrong answers were being taught as late as three hundred years ago – and Aristotle lived in the fourth century B.C.! Aristotle's big mistake was his failure to test his theories with experiment. Whether or not this was a deliberate omission is an interesting question. My may well be that the deification of logic caused the Greeks to overlook such a secular activity as experimentation. Imagine what the world would be like today if science had started off on the "right foot" two thousand years ago!

The serious blot on the record of Aristotle's vast contribution to man's ability to reason is that many of his answers were the wrong ones.

There is a valuable lesson to be learned by every physicist and engineer from these two thousand years of scientific eclipse. Aristotle intuitively reasoned that a body propelled by a given force should move with twice the velocity of a body propelled by half the force. The mathematical equivalent of this statement would be, **F = mv – a** somewhat different result from the classical, Newtonian formula, **F = ma**. It is unnecessary to explain the havoc that the former equation would produce in one of our college courses – dynamics, for example! In a similar vein the Greek philosopher authoritatively stated that he heavier a body is the faster it must fall. Galileo was nearly excommunicated for daring to prove the falsity of this statement by making his famous experiment from the top of the tower of Pisa. Aristotle erred when he said that because a statement sounded logical it must be correct. He failed to put his conclusions to the test. It is not difficult to any age to make this error of omission.

It should not be construed that he intuitive approach is to be frowned on. Scientific guessing is a legitimate method in problem solving. As a matter of fact, the solution of many differential equations consists of guessing the answer and testing the guess in the original equation. The Greeks were prolific guessers. They devised so many untested suppositions concerning the composition of matter that there was even an atom theory that had to lay dormant for centuries. It is true that there was little means for experiment of this nature, but the unforgivable action was the declaration of fancy as absolute fact.

From the time of Galileo, experimentation has established its worth and the scientific textbooks are filled with the contributions of investigators in every field. One believes what he reads because he knows that behind an important statement of fact may lie many hours, days – even years- of experimental evidence. The difficulty of obtaining accurate measurements can often delay an experimental proof. When Newton first applied his law of gravitation to the moon, the available data was inexact and his calculations did not agree with the observations. Not until better measurements were made could he verify his hypothesis.

The limitations of experimental data must also be considered in arriving at conclusions. When Einstein gave his theory of relativity to the world and its revolutionary ideas were made known, there were persons who gleefully relegated the proponents of Newtonian mechanics to the position of the defunct Greek philosophers. Since the publication of the "theory" in 1905, physical and engineering problems are still being solved successfully with classical mechanics and bid fair to do so for some time to come. Scientists now recognize that generalizations on certain experiments were more inclusive than the experiments allowed. When new experiments seem to refute accepted theories then other theories must be propounded.

The history of science contains many instances of the scrapping of old theories for new ones. It is one of the aims of science to provide a consistent theory, containing a few postulates, which will explain all the physical phenomena of nature – from the movements of the heavenly bodies to the infinitesimal particles of nature. Newtonian dynamics cannot do this and for that matter neither can Einstein's relativity. The separate theories of gravitational forces and electromagnetic fields, the quantum theory, wave mechanics, etc., have not as yet been unified. Only through more experimentation and the proper interpretation of the results will this goal be some day achieved.

Elephant Hunters

From http://www-personal.umich.edu/~dunlapg/screwytexts/elephants.html

- MATHEMATICIANS hunt elephants by going to Africa, throwing out everything that is not an elephant, and catching one of whatever is left.
- EXPERIENCED MATHEMATICIANS will attempt to prove the existence of at least one unique elephant before proceeding to step 1 as a subordinate exercise.
- PROFESSORS OF MATHEMATICS will prove the existence of at least one unique elephant and then leave the detection and capture of an actual elephant as an exercise for their graduate students
- COMPUTER SCIENTISTS hunt elephants by exercising Algorithm A:

5. Go to Africa.
6. Start at the Cape of Good Hope.
7. Work northward in an orderly manner, traversing the continent alternately east and west.
8. During each traverse pass,
1. Catch each animal seen.
2. Compare each animal caught to a known elephant.
3. Stop when a match is detected.

- EXPERIENCED COMPUTER PROGRAMMERS modify Algorithm A by placing a known elephant in Cairo to ensure that the algorithm will terminate.
- ASSEMBLY LANGUAGE PROGRAMMERS prefer to execute Algorithm A on their hands and knees.
- ENGINEERS hunt elephants by going to Africa, catching gray animals at random, and stopping when any one of them weighs within plus or minus 15 percent of any previously observed elephant.
- ECONOMISTS don't hunt elephants, but they believe that if elephants are paid enough, they will hunt themselves.
- STATISTICIANS hunt the first animal they see N times and call it an elephant.
- CONSULTANTS don't hunt elephants, and many have never hunted anything at all, but they can be hired by the hour to advise those people who do.
- OPERATIONS RESEARCH CONSULTANTS can also measure the correlation of hat size and bullet color to the efficiency of elephant-hunting strategies, if someone else will only identify the elephants.
- POLITICIANS don't hunt elephants, but they will share the elephants you catch with the people who voted for them.
- LAWYERS don't hunt elephants, but they do follow the herds around arguing about who owns the droppings.
- SOFTWARE LAWYERS will claim that they own an entire herd based on the look and feel of one dropping.
- VICE PRESIDENTS OF ENGINEERING, RESEARCH, AND DEVELOPMENT try hard to hunt elephants, but their staffs are designed to prevent it. When the vice president does get to hunt elephants, the staff will try to ensure that all possible elephants are completely prehunted before the vice president sees them. If the vice president does see a nonprehunted elephant, the staff will (1) compliment the vice president's keen eyesight and (2) enlarge itself to prevent any recurrence.
- SENIOR MANAGERS set broad elephant-hunting policy based on the assumption that elephants are just like field mice, but with deeper voices.
- QUALITY ASSURANCE INSPECTORS ignore the elephants and look for mistakes the other hunters made when they were packing the jeep.
- SALES PEOPLE don't hunt elephants but spend their time selling elephants they haven't caught, for delivery two days before the season opens.
- SOFTWARE SALES PEOPLE ship the first thing they catch and write up an invoice for an elephant.
- HARDWARE SALES PEOPLE catch rabbits, paint them gray, and sell them as desktop elephants.

If you know any funny engineering or science jokes, puns, lists, or stories you would like to share, please send them to the Engineers' Forum Mail Bag at forum@vt.edu.

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