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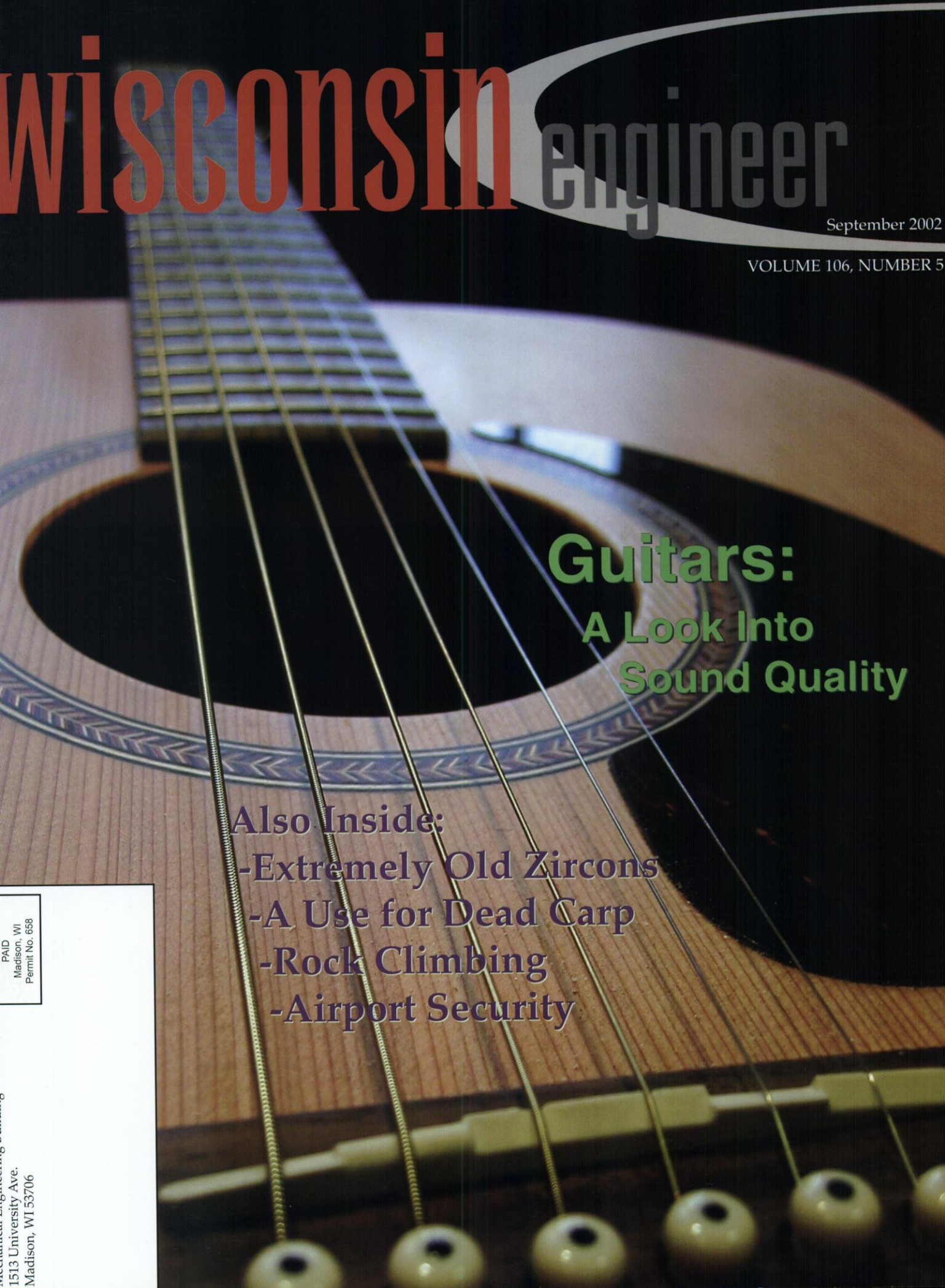
wisconsin engineer

September 2002

VOLUME 106, NUMBER 5



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A Look Into Sound Quality

Also Inside:
- Extremely Old Zircons
- A Use for Dead Carp
- Rock Climbing
- Airport Security

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wisconsin engineer

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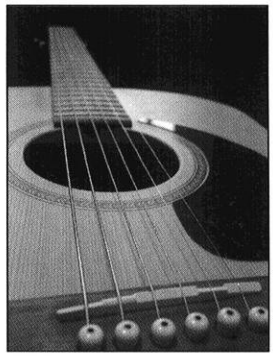
FEATURES

On the Cover:

The first guitars were the size of ukuleles and strung with four silk strings. Today, guitars come in many sizes with many types of strings available.



COMMENTARY

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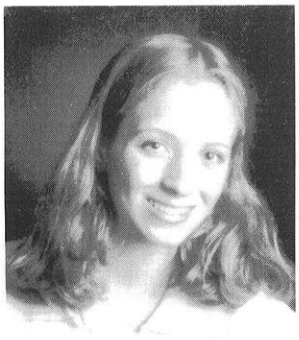

Karen Mandl

E is for Engineering

As part of the Y2K hoopla in December 1999, I watched a special on the History Channel about the most-however-many influential people of the past 1000 years. Do you know who the number one person was? Johann Gutenberg, the inventor of the printing press. What?!? How could that be? I thought it would be more exciting than that. The printing press affected the growth and development of the human race by allowing knowledge and ideas to be passed from one person to another. Gutenberg's presence at the top of the list demonstrates the importance of communication, a concept many engineers take for granted. I like to call it the "but I am an engineer" excuse.

A few weeks ago, I was attempting to convince one of my engineering classmates to join the Wisconsin Engineer writing staff. After a quick laugh, she responded.
"I can't write."
"We can help you."
"Nah, I don't need to know, I'm an engineer."
Oh dear.

Not that I can blame many engineers for feeling this way. The English department is conveniently located as far away from the engineering campus as you can get. And it is never mentioned amidst our thermodynamics and transport phenomena lectures how important communication is to the engineering profession. But what good is all of the scientific knowledge if you are unable to share your amazing discoveries with others?

One of the challenges facing engineers and scientists is bringing their work to the public and explaining technical topics in a non-technical manner. It is a skill that is just as important as doing integrals or mass balances. Engineering firms and companies that best communicate what they are doing to the general public are doing more business and have better public image than those who do not. And surveys done by Engineering Career Services say the skills employers are looking for the most in new-hires are communication skills. "Communication is the name of the game," Professor Jim Converse of the Biological Systems Engineering Department states. "Engineers who know how to communicate their ideas will be the greatest asset to any company or community."

I am not saying that every engineer does not realize the importance of communication or uses the "but I am an engineer" excuse. There are many engineers who have strong writing and communication skills along with strong technical knowledge. Gutenberg was not a writer; he was an inventor, an engineer of sorts, but he did realize the importance of communication. So much that he influenced it for the rest of time.

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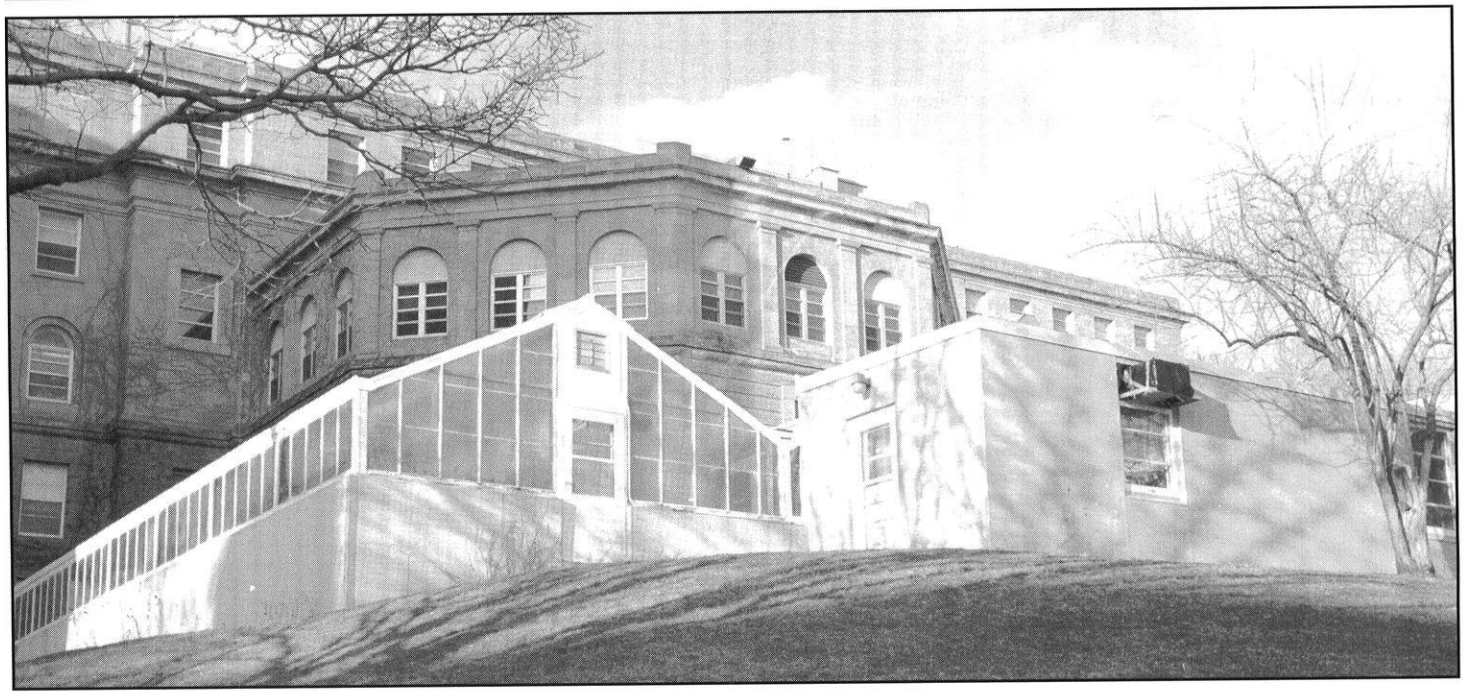
A Visit To The Birge Hall Greenhouse

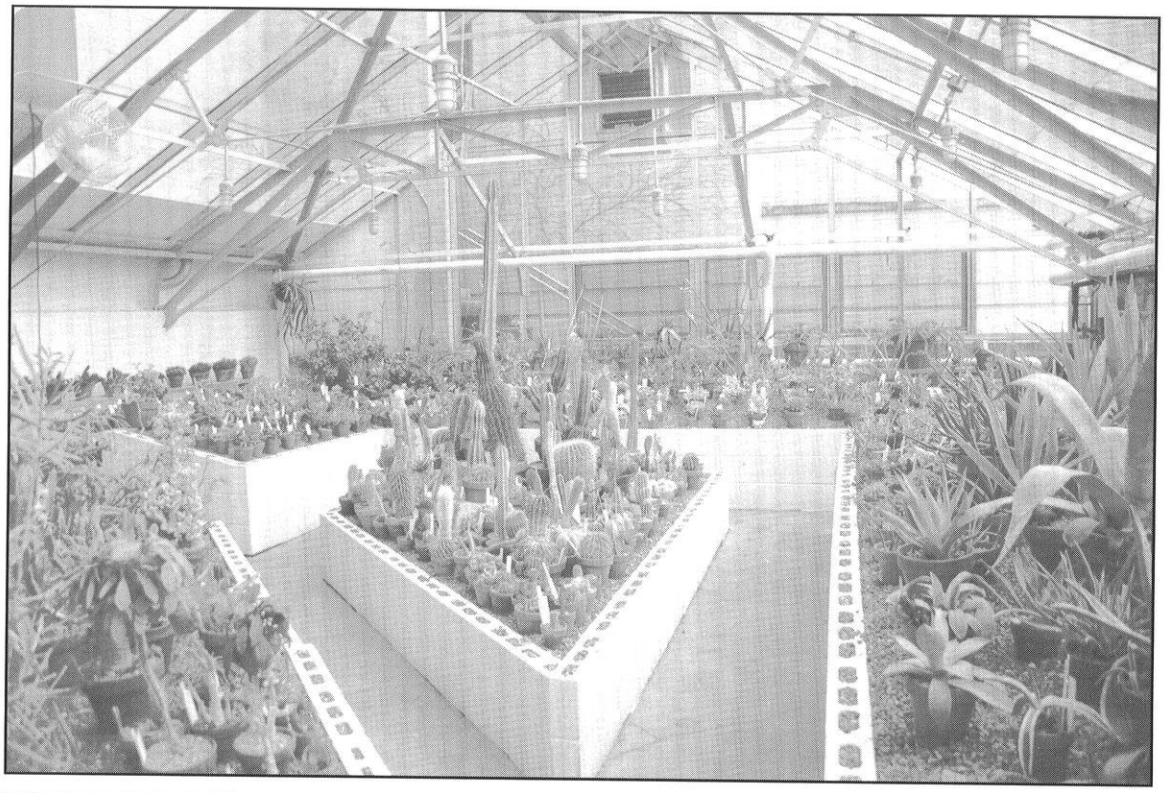
A Look At Flowers From Around the World

By Carl Calhoun



The Birge Hall Greenhouse contains over 1,000 species of plants from around the world, according to UW-Botany Greenhouse and Botannical Gardens director, Dr. Mo Fayyaz. Most of the plants are used as educational aids in the university's Botany 100 and 130 courses. Dr. Fayyaz has been working for several years to update and remodel the greenhouse structure. "My two primary concerns are to the safety of the people and optimal conditions for plant growth," says Dr. Fayyaz. Improvements include complete remodeling of two rooms and addition of sprinkling systems. The remodeled rooms feature aluminum framework and tempered glass a big improvement over the deteriorating wood and glass construction they replaced. Dr. Fayyaz is also looking forward to a botannical garden expansion. "There are a lot of things being done. We're trying to make [the greenhouse and garden] not only a part of the university, but also a part of the community." The greenhouse is open to the students and public from 8:00am to 4:00pm.

This orchid (below), Phalanenopsis CH 9545, is one of more than a thousand species that can be found at the Birge Hall Greenhouse (above).

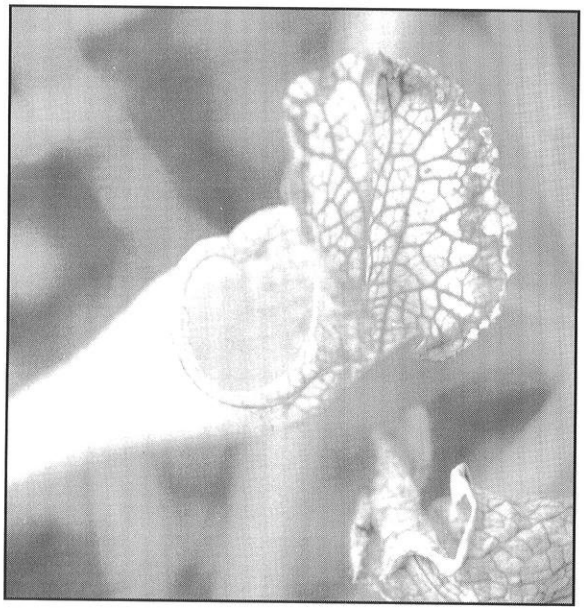


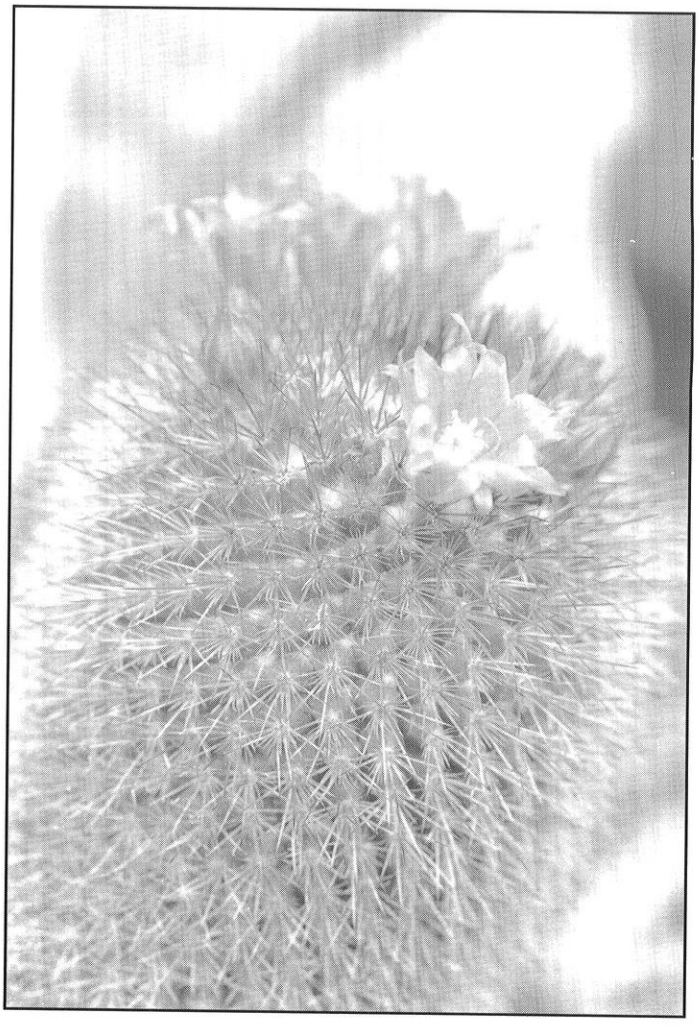
Top:This is the remodeled semi-arid room, containing various species of cacti.

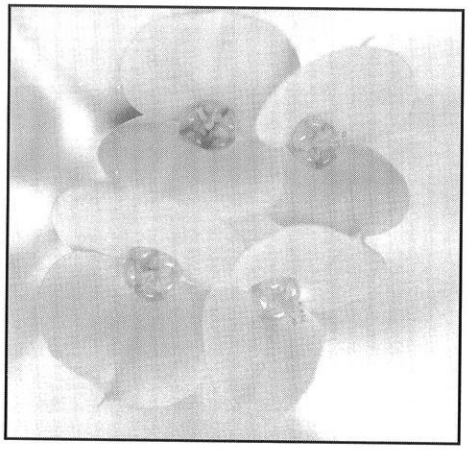
Mid left: This pitcher plant uses its specially-shaped leaf to capture and digest insects.

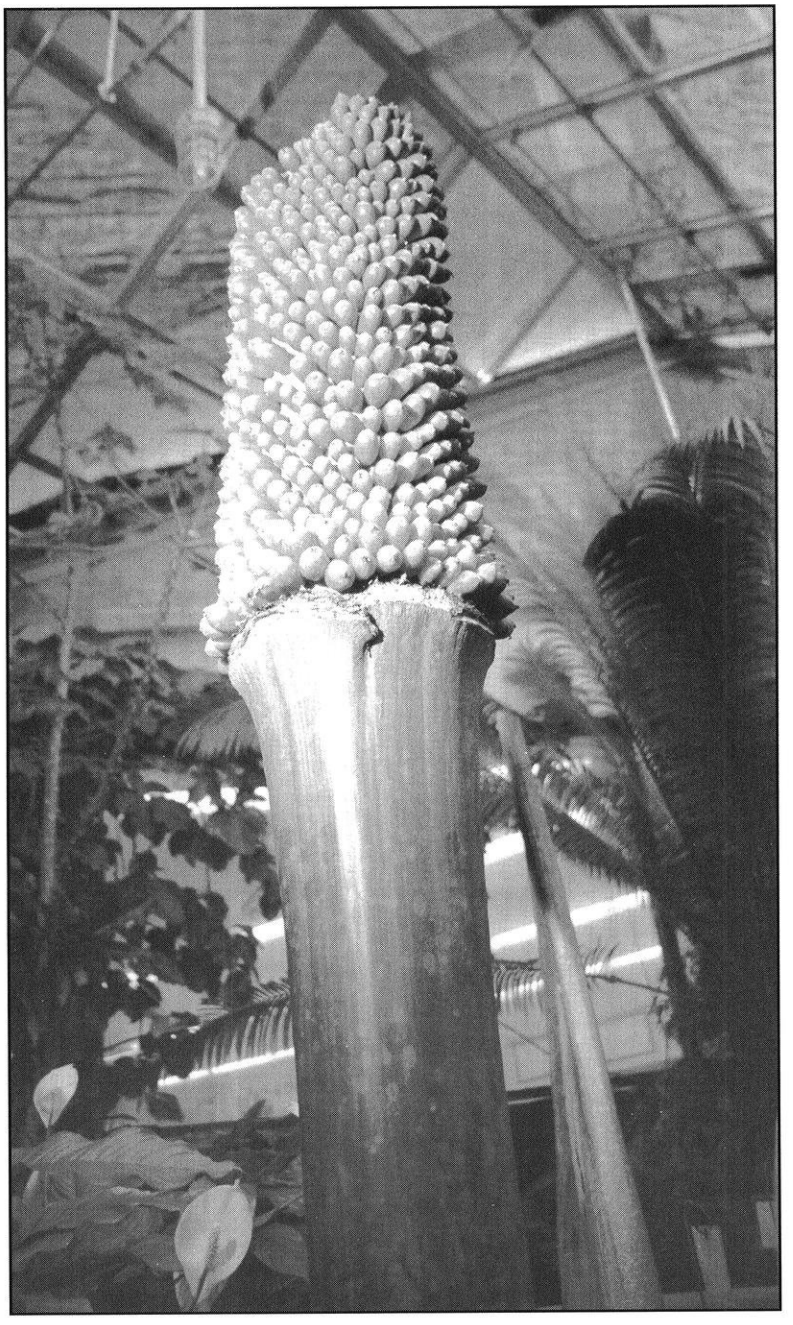
Bottom left: Mammillaria spinosissima

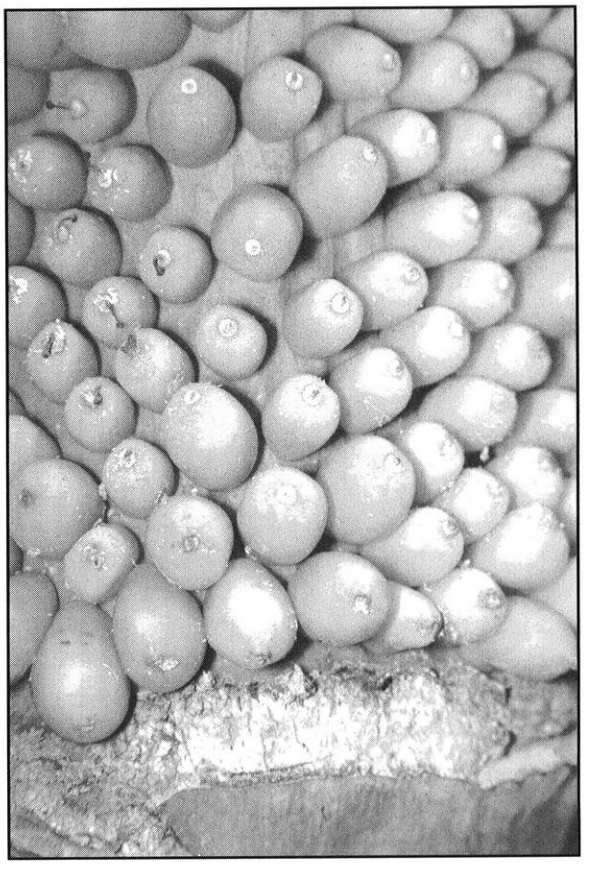
Far right: Brain cactus (Echino fossulocactus)







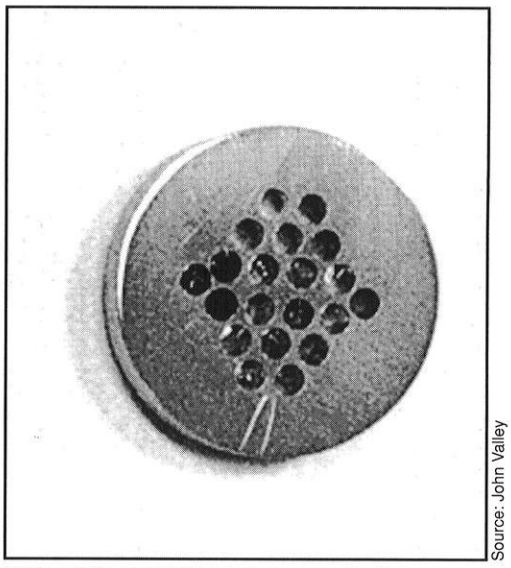




The Titan Aurum, Amorphophallus Titanium, (left), is the world's largest flower. The plant originates from the old world tropics of Sumatra. Seeds for the plant were given to the university by Tom Gibson, and raised in the greenhouse. Once the flower bloomed, it was pollinated by hand by Paul Berry, Director of Herbarium. Seeds from this flower (above right) have been shipped to Sumatra, Australia, Brazil, Mexico, among others.

Lower left: Crown of Thorns (Euphorbia milli), from Madagascar.

The Beauty of a Finely-Aged Zircon



Source: John Valley

This slide contains many small zircon samples prepared for a microscope.

By Ellen Considine

In 1980, a university professor went searching for gold in the Jack Hills of Western Australia—but he found something much better. Dr. Simon Wilde of Curtin University of Technology was curious about the Jack Hills metaconglomerate, which reminded him of the South African ore body (the Witwatersrand metaconglomerate) from which half the world's gold has come. He began mapping the Jack Hills in 1980, and in 1984 he struck... zircons.

Zircons, as geologists will emphatically remind you, are not the same as cubic zirconia. For one thing, they have different chemical compositions. For another, natural zircons are usually small and brownish. While jewelers and prom queens may snub the unassuming zircon, it is an invaluable tool to geologists.

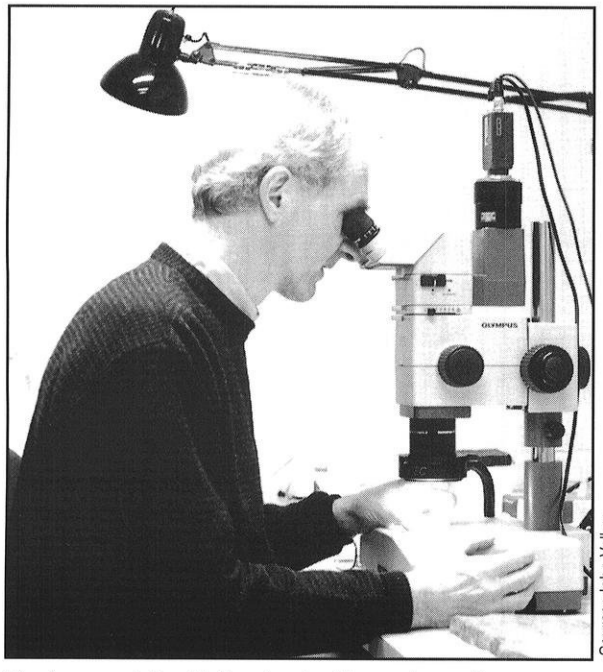
When zircon crystallizes, it concentrates uranium (U) and excludes lead (Pb). Since lead only appears in zircon crystals through uranium decay, the measured U:Pb ratios are a true reflection of the crystal's age, making zircon an incredibly accurate dating tool. Also, zircon holds two uranium isotopes—both U-235 and U-238, which decay into Pb-207 and Pb-206, respectively. Geologists can correlate their results by measuring the decay of both uranium isotopes.

While jewelers and prom queens may snub the unassuming zircon, it is an invaluable tool to geologists.

In 1984, Wilde collected a rock sample that contained a 4.27-billion-year-old zircon, the oldest known earth-born crystal. To appreciate the importance of a 4.3-Ga (billion-year-old) crystal, consider that:

- The earth is 4.6 Ga
- The oldest known rock—Acasta gneiss—is 4 Ga
- The oldest known fossils are 3.5 Ga

Like antique furniture, very old rocks and crystals are rare and therefore valuable. They hold unique information about early Earth.



Source: John Valley

Professor John Valley looks through a microscope at zircons.

When Professor John Valley of UW-Madison's Geology department met Wilde in 1998, Valley asked if he could study Wilde's 4.27-Ga zircon. Valley and William Peck of the University of Edinburgh hoped to analyze the zircon's oxygen isotope ratio. Wilde didn't have the zircon with him, but he did have thousands of others.

In May 1999, Wilde dated some of those thousands, among them a 4.4-Ga zircon—even older than the zircon dated in the 1980s. Only 220 mm across, it is the oldest terrestrial crystal ever found—a full 103 million years older than Wilde's 4.27-Ga crystal. This zircon could give geologists a redefined picture of early Earth's conditions.

Earth formed 4.6 billion years ago as a dense body of gas and dust. As this mass came together, it acquired gravity and drew in meteorites. Eventually, Earth's own gravity led to differentiation into core, mantle, crust and atmosphere, increasing in density away from the center. The core is molten iron; the mantle consists of dense, iron-rich minerals like olivine; and the crust is lighter, silica-rich rock like granite and basalt. The continents rest on granitic crust and the oceans sit on basaltic crust.

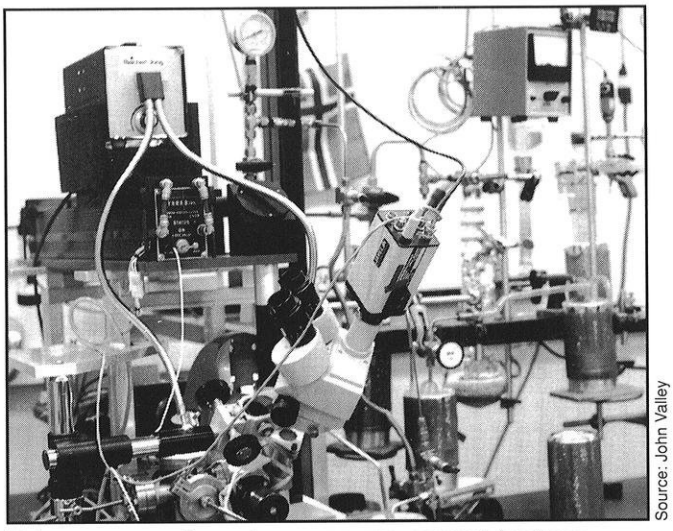
"It slowly dawned on us that we were seeing an abnormally high ratio of oxygen 18 to 16...it forced us to reevaluate what we thought were the conditions [when Earth was formed]."

But when did accretion and differentiation start, and how long did they take? By applying their knowledge about how, where and when crystals form, geologists can answer those questions.

The significance of a 4.4-Ga zircon lies in *where* it formed. Zircons often crystallize in

granite, and tiny mineral inclusions in Valley's zircon match the minerals found in granite. Moreover, Rare Earth Element (REE) analysis suggests the zircon formed in a mature magma.

As crystals form, they pick up traces of Rare Earth Elements—uncommon, bottom-row elements like Lanthanum, Cerium, Samarium and Europium. Different geologic settings have their own REE signatures, so rocks that formed deep in the mantle will have a different signature than rocks that formed closer to the surface. According to its REE signature, Wilde's zircon formed in a mature magma nearer to Earth's surface, which agrees with the zircon's granite-like inclusions. A 4.4-Ga zircon means that only 200 million years after formation, Earth's interior had cooled and differentiated enough to form continental crust like granite.

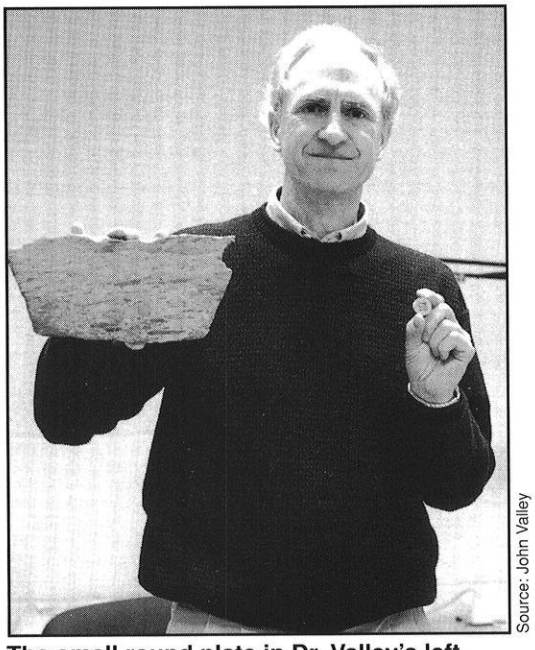


Source: John Valley

This mass spectrometer measures oxygen isotope ratios as well as uranium:lead ratios.

Some geologists had thought that from the time of its formation (4.6 Ga) until 3.8 Ga, Earth was under intense meteorite bombardment. This energy influx would have created sweltering volcanoes and lava oceans, an environment too hot to support water. But the zircon's high oxygen isotope ratios suggest otherwise.

In July 1999, Valley and Peck took Wilde's 4.4-Ga zircon to the University of Edinburgh. They met with Colin Graham of the University of Edinburgh and worked 14-hour shifts on Edinburgh's Ion Microprobe/Secondary Ion Mass Spectrometer (SIMS), one of only eight in the world. This $2.9 million instrument works on a nano scale, allowing researchers to see components within a single bacterium or grain of sand. By shooting a stream of cesium and oxygen ions at the zircon grain, Valley and Graham dug holes so small that the SIMS could make several passes across the zircon grain. A mass spectrometer analyzed the detritus from each digging—about 5 ng of material—for oxygen isotopes.



Source: John Valley

The small round plate in Dr. Valley's left hand contains thin sections of zircons found in rocks like the Jack Hill's quartzite in his right hand.

Just as uranium isotope concentrations show the age of a crystal, oxygen isotope concentrations reveal the crystallization temperature. By measuring the ratio of 18O to 16O, Valley, Graham and Peck could calculate the proportion of 18O (d18O). d18O values are high in modern rocks, which formed at cool temperatures, and low in mantle-derived rocks, which formed at high temperatures. Valley and Graham expected a low d18O ratio, meaning that the granite's parent rock had been in a hot, near-molten environment. Valley says that then, "it slowly dawned on us that we were seeing an abnormally high ratio of oxygen 18 to 16...it forced us to re-evaluate what we thought were the conditions."

The high ratio they found indicated a cool early Earth, lacking the meteorite blitz geologists had imagined. A cooler Earth may have been capable of supporting liquid water—one of three things necessary for the evolution of life (the others being organic molecules and energy). We know that organic molecules and energy were present on early Earth, so the presence of liquid water could change our understanding of early biology as well as geology.

But where did the zircon come from? There might still be other zircons from the same crystallization event. Several research groups are extracting zircons from Jack Hills quartzite, dating those crystals and analyzing their isotopic properties. Aaron Cavosie, a PhD student from the UW-Madison Geology department, is also researching the zircon. He says, "Zircons are flashy, they are tried-and-tested and are very reliable for dating."

"Zircons are flashy, they are tried-and-tested and are very reliable for dating."

UW-Madison, however, doesn't have a SIMS, making it inconvenient to analyze individual zircon grains. So Cavosie is researching the zircon from another direction, by studying other rocks in the Jack Hills. The 4.4-Ga zircon was found in a metaconglomerate, and he hopes to answer questions like:

- What other pebbles are in the conglomerate?
- Where did those pebbles come from?

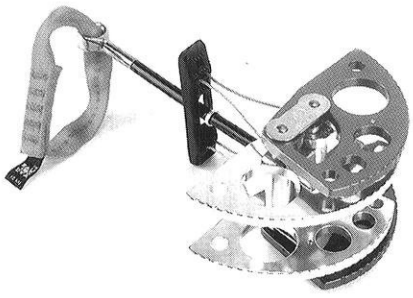
Ultimately, Cavosie wants to learn more about the zircon's provenance—its place of origin—which will in turn tell about the zircon's parent rocks. The parent rocks may hold even more clues about early Earth.

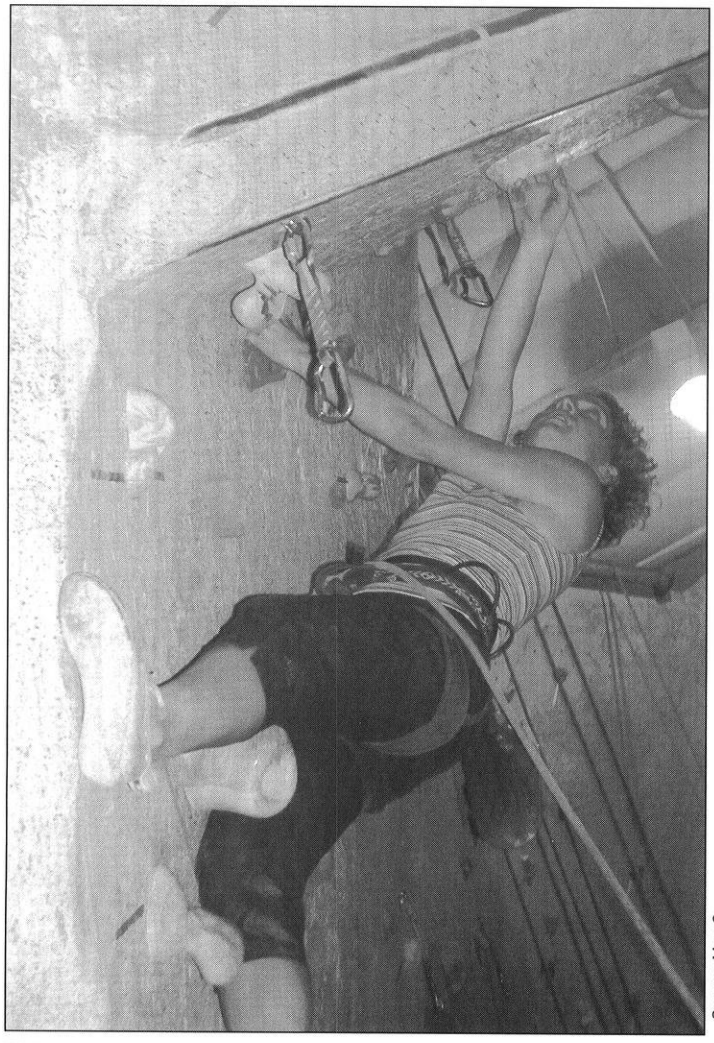
All this from one zircon grain. As Valley states, "In order to understand big processes in geology we have to analyze ever smaller samples."

Thanks to John Valley and Aaron Cavosie.

Author Bio: Ellen Considine is a senior in Geological Engineering. She thanks John Mayer for putting the periodic table on his CD-ROM for Squares, which proved useful in writing this story.

Vertical engineering





Source: Meg Cox

This climber has much more sophisticated equipment at her disposal than the first climbing engineers over 300 years ago.

By Land Belenky

Somehow engineers got the reputation for being, well... shall we say, geeks? This really isn't the case. If you're willing to look past the occasional debate over who makes the better graphing calculator, you'll find that engineers tend to be thrill seekers by nature—as evidenced by their attraction to mountain climbing. Engineers took to the mountains hundreds of years before Mountain Dew tried to convince us that drinking soda was an extreme sport.

Perhaps the first great engineer climber was Horace Bénédict de Saussure (1740-1799). A Swiss professor of physics, he looked at Mont Blanc towering over his hometown of Geneva and realized that the highest point in the Alps was the perfect place to perform atmospheric experiments. The problem was that it had never been climbed, and it was widely believed that no one could survive the thin air and low temperatures at 15,780 feet.

Saussure offered a reward for the first ascent of Mont Blanc. A geologist and physicist succeeded on August 8, 1786, ushering in what came to be known as the Golden Age of mountaineering. A few years later, when he was almost 50 years old, Saussure climbed Mont Blanc himself, camped and performed high-altitude physics experiments. A statue in Chamonix, at the base of Mont Blanc, commemorates Saussure's contribution to the sport of climbing, and a museum in Geneva commemorates his many contributions to science and engineering.

The relationship between climbing and engineering lasts to this day. Other engineers who contributed to the development of climbing include Ricardo Cassin and Yvon Chouinard, metallurgists who made their own equipment and created standard-setting routes in the Alps, the Tetons, Alaska and anywhere else a vertical rock could be found.

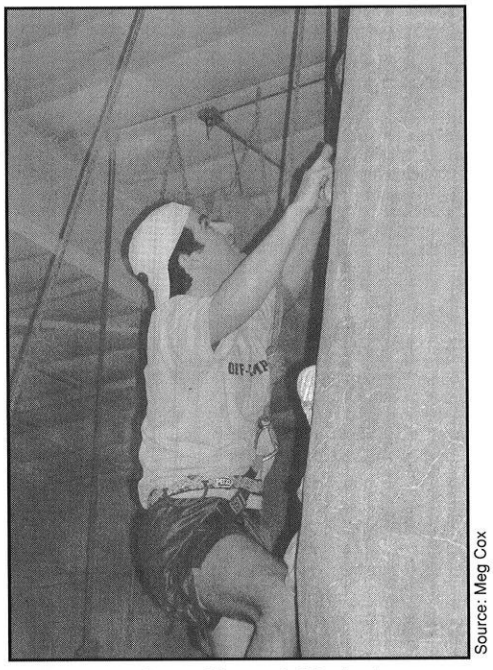
Yarrow Fewless, a UW-Madison engineering student and climber, can often be found at Boulder's Climbing Gym. He can name a dozen famous engineer climbers without a moment's reflection. According to Yarrow, climbing legend Alex Lowe was known to bring calculus books on expeditions and run through derivations while belaying leads. Ray Jardine, an aerodynamical engineer, was the first man to climb the astonishingly difficult grade 5.13. He also invented a clever device called a cam.

Possibly the most visually appealing of all climbing equipment, the cam is used to anchor the rope to the rock so that, should a climber fall, she will safely swing to a stop. Protection such as this must be light enough to carry, easy to position with one hand and strong enough to withstand the force of a tremendous fall. Additionally, it should fit a range of crack widths, have consistent strength and hold its position in the crack without damaging the rock. Jardine found

the solution to these requirements in an equation: r = K-.

This simple equation defines the logarithmic spiral which was first studied by Descartes in 1638. Torricelli studied it, as did Bernoulli, who liked it so much he had it engraved on his tomb. You've probably seen it in seashells and sunflower seeds. Hundreds of amazing properties of the spiral have been discovered, including its relationship to the Fibonacci numbers and the golden ratio.

Jardine (and the makers of hundreds of other cams based on his designs) used the logarithmic spiral because the angle between the direction of pull and the direction of force is a constant. Thus, whether the cam is completely retracted to be inserted into a narrow crack or expanded to fit a wider crack, the pull-out strength is the same. Unlike conventional or passive protection, which is nothing more than a lump of metal on a cable, a cam can fit a wide range of crack sizes, even cracks with parallel or slightly flared sides.



Source: Meg Cox

Pulleys on the ceiling of this indoor gym protect this climber from a fall. A cam (pictured above left) serves the same purpose on a real rock face.

The weight reduction achieved with cams, combined with their simplicity of use and ability to protect previously unprotectable climbs, has opened up new frontiers in climbing. Where previously a climber would be forced to stop and pound a stake (or piton) into a rock, now she can simply grab a cam, pull the trigger, clip and continue. Advances like this have helped speed records on great climbs like El Capitan fall from days to mere hours.

There's a lot to worry about while climbing, but you should find it comforting that 400 years of cutting-edge mathematics are backing up your equipment.

Where to Climb

♦ Think Wisconsin is flat? Well, okay, you're right – but that doesn't mean there's nowhere to climb. For indoor climbing, the locals prefer Boulder's Climbing Gym (244-8100) but if you don't mind driving a little further, Adventure Rock ((262)-790-6800) in Pewaukee is Wisconsin's largest. Either gym will be happy to rent you equipment and give you a beginner's course.

♦ During a normal winter, good ice climbing can be found at Governor Dodge State Park, but where Wisconsin really shines is the bluffs at Devil's Lake, just south of Baraboo. Climbers come from all over the Midwest (mostly Chicago) to spend a day on the 1600 routes suitable for all abilities. If you need something more challenging, the next closest is the Red River Gorge, ten hours away in Kentucky.

Author Bio: Land Belenky is a graduate student in Materials Science. He gets gripped on 5.7. Thanks to Yarrow Fewless who helped with this article. He's a senior in Mechanical Engineering and can usually be found at Boulder's Climbing Gym practicing what he preaches.

Metal Injection Molding:

Shaping the future of machined parts

By Andrew Wentland

If you have ever ridden in a car, used a computer or undergone surgery, you have dealt with machined parts. The modern economy depends on the fact that people use machined parts every day. As both society and technology develop, the processes used to produce and refine these parts also must change. Specifically, the times demand improvements in efficiency, cost and application.

"Metal injection molding's greatest benefit is to offer significant cost savings of expensive secondary operations... "

The most common processes to make parts, such as for toys and electronics, are die casting and plastic injection molding. Die casting injects liquid metal into a pre-formed mold to acquire the desired shape. Plastic injection molding uses similar techniques with liquid plastic. Nearly all plastic utensils and toys are made by injection molding. Stepping on a child's toy will reveal that machined objects are fragile—though perhaps not as fragile as your foot.

A new process, metal injection molding (MIM), was developed in the 1980s to make metal products formed from molds denser and more durable. MIM injects a custom metal powder into a wax casing within a rigid mold. Once the powder is injected into the mold, the system is placed in a climate- and pressure-controlled furnace. The metal shrinks, the wax melts away, and the final product (40% smaller than the mold) remains. This process can form objects of variable sizes, such as bolts, utensils and circuitry for machines. This freedom from size limitations is a major advantage of MIM.

Metal injection molding achieves the improvements in efficiency, cost and application demanded by industry today. One of the primary motivations behind the development of MIM was the fact that neither die casting nor plastic injection molding produce a finished product fresh from the mold. These processes require extensive machining, such as lathing, to complete a part. MIM creates a finished product without further machining, demonstrating its effectiveness as opposed to other processes.

Clayton Allen, manager of applications engineering with Textron Fastening Systems (TFS), is TFS's authority on MIM. "Metal injection molding's greatest benefit is to offer significant cost savings of expensive secondary operations and eliminate design restrictions inherent in other metalworking technologies by achieving close tolerancing," Allen says. Close tolerancing produces a denser (stronger) product through high furnace pressure and careful heat control.

Stronger parts, however, come at a cost. To use MIM, a corporation must pay approximately $30,000 for initial costs, compared to $10,000 for die casting or plastic injection molding. Yet die casting and plastic injection molding require other machines to finish their parts, and these machines wear out more quickly than MIM machines. Though MIM's cost may be higher, its efficiency makes it longer-lasting—and therefore cheaper.

"In conventional molding," Allen says, "costs are somewhat lower in the initial costs. However, through continuous use, tooling begins to wear [the machines], requiring replacement parts and added cost. Secondary operations [lathing and further processing] are eliminated [with MIM] because near shape designs are achieved during molding."

Corporations are choosing MIM because of the long-term savings and high-quality products the process yields. "In the case where customers require five or more machine tool set-ups or secondary manufacturing paths to complete a part," says Allen, "MIM is by far the best alternative and least expensive option."

So what is actually being done with MIM? The dominant materials used for MIM are stainless steel, chrome steel, precipitation-hardened stainless steel, nickel, iron and titanium. The biomedical field can use MIM components for surgical operations such as cartilage incision. The automotive industry can use them for the exhaust gas recirculation (EGR) valves in cars. The space program can even use MIM for higher-quality parts on spacecrafts.

"The automotive and steel industries impact over 450 billion dollars per year worth of commerce within the U.S. alone," reports the Environmental Protection Agency (EPA). "Presently, enormous amounts of finish waste, environmentally undesirable byproducts and emissions result from these operations." Common processes fail to prevent these hazardous results.

"...and eliminate design restrictions inherent in other metalworking technologies by achieving close tolerancing,"

The EPA would like to see MIM used in corporations for the following purposes:

- Elimination of the need for very high forming temperatures and associated greenhouse gas emissions
- Reduction of secondary hazardous metal wastes as well as gaseous, liquid and solid wastes from current levels by over 90%
- Improvement of yield from raw materials (less materials = less environmental impact from raw materials industries)
- Production of products of improved quality (density, tolerance, mechanical properties and reliability)

Metal injection molding is still new. More industries are adopting this process because the benefits are boundless. "MIM processing is an ever-evolving manufacturing process,"

says Allen. "As research continues, new techniques and materials are often developed and offered to a range of customer requirements—like within the dental and medical fields where precision is required."

From the improvement of machines to cost to environmental standards, MIM will continue to change our lives. "The possibilities are endless," says Allen. We

Author Bio: Andrew Wentland is a sophomore in engineering. He finds it amusing to say "MIM" excessively.

Material	Uses
♦ Stainless Steel	Medical industry, appliances
♦ Chrome Steel	Electrical Components
♦ Precipitation Stainless Steel	Medical, automotive and aeronautics industries
♦ Nickel Iron	Automobiles, machine parts
♦ Titanium	Watch components, medical and dental industries

E-business-In or *Out?*

By Lizabeth Wyma

To make it big in today's world, you need more than just an ingenious idea. Not even the most brilliant work of engineering stands a chance without proper marketing. Many engineers and companies have turned to "e-business" in the struggle to remain competitive. For e-business giants like Amazon.com and Ebay, the past few years have been marked with tremendous success. Many have even suggested the possibility of e-business replacing the local strip-mall and shopping center.

But will e-business continue to expand, or has it hit its peak? As many experts debate the future of e-commerce, businesses examine their budgets in the suffering economy and ask: how important is e-commerce?

Countless factors determine where e-business will stand in the future, but many, such as September 11th, threaten to end its progress. It seems that September 11th has affected everyone and everything in the country, including e-business.

With the United States economy in recession, businesses have to make cuts in their budgets, and e-business seems to be a good place to start. E-commerce can be a financial risk to companies. While some e-businesses turn into monsters like Ebay, others fizzle out before any web surfers even realize they exist.

Another factor indicating that e-business is declining is its aging technology. Business Web sites are no longer a hot new commodity. The medium of a Web site isn't as appealing to businesses as it was when commerce first started going online, especially for new businesses breaking out into the scene. Small business Web sites get lost among the millions of business sites because they cannot afford the advertising and exposure needed to let customers know they are on the Web. Companies are now looking for new approaches to the market rather than spending more on the aging and cluttered World Wide Web.

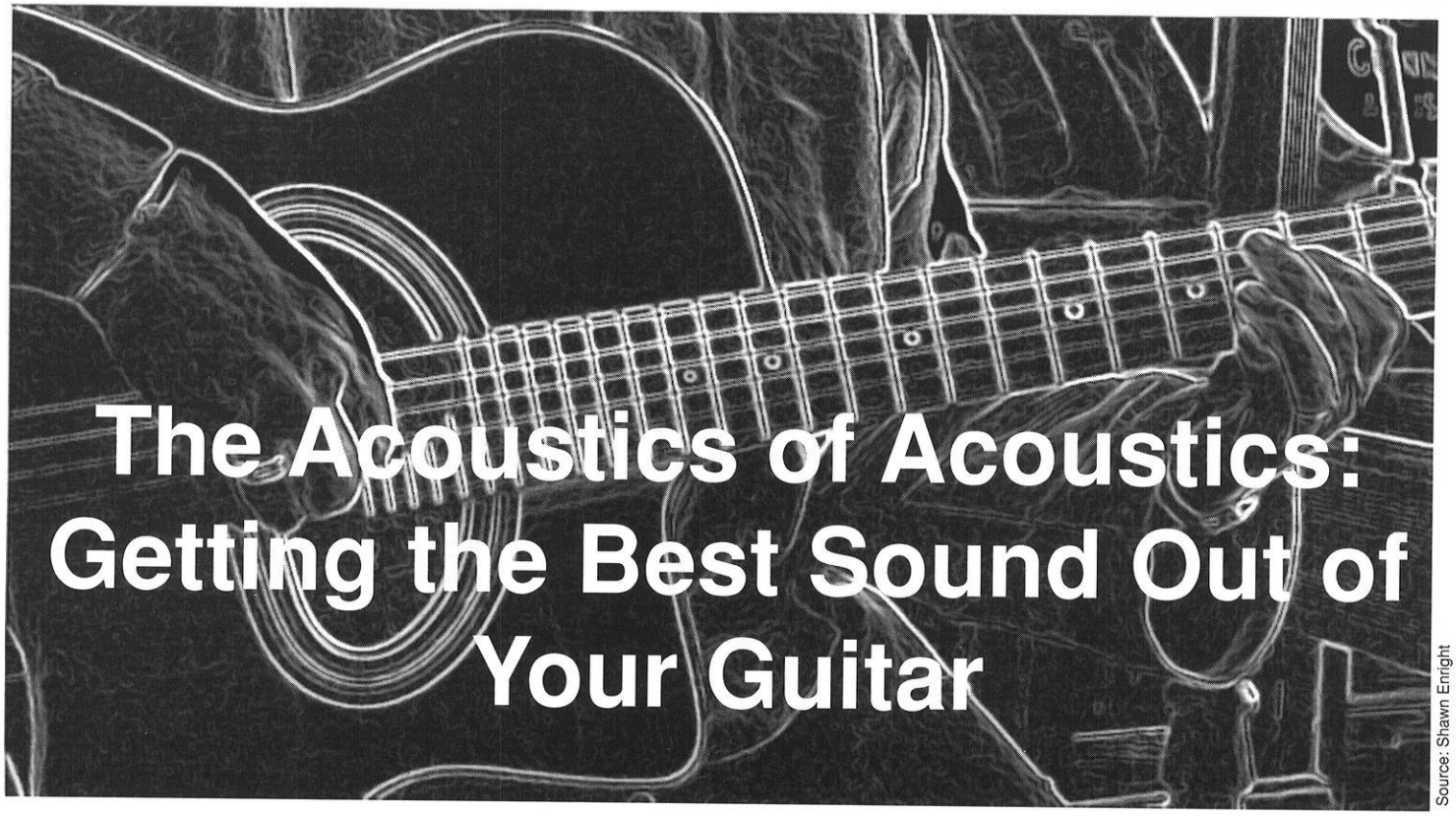
While some e-businesses turn into monsters like Ebay, others fizzle out before any web surfers even realize they exist.

Although it may seem logical that businesses increasingly cut their e-commerce because of its apparent ineffectiveness, an InformationWeek survey shows that the majority of the 300 companies interviewed plan to increase investment in e-business this year. Many companies believe that e-business is still worthwhile, considering that consumers rang up 65% of the November-December 2001 holiday season purchases online.

So where is e-commerce headed? The answer to that question depends on an uncertain combination of factors, both within and without the business world. We

D'Antoni, Helen. "E-business proves a worthy investment." InformationWeek. Jan 14, 2002: 64+.
Goldberg, Aaron. "Out with 'e-business.'" Adweek Magazines' Technology Marketing. Feb 2002: 6+.

Author Bio: Lizabeth Wyma is an English major with a Technical Communication Certificate.



The Acoustics of Acoustics: Getting the Best Sound Out of Your Guitar

Source: Shawn Enright

By Aaron Bock

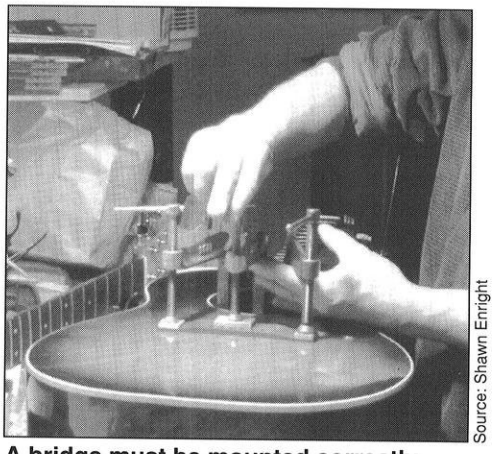
Anyone who has ever attended a Bob Dylan, Neil Young or Jimmy Buffett concert can appreciate the music produced by a good acoustic guitar. However, good guitar playing does not necessarily equate to good sound. A poorly manufactured acoustic guitar or the wrong equipment can even nullify a talent like Eric Clapton's. Many professional guitarists will tell you that a truly good sound integrates both raw skill and a good instrument. So whether you own an Epiphone AJ-10 or a Martin & Company Paul Simon Signature, it is important to know what factors influence a guitar's sound.

The many features of the modern acoustic guitar lead to a wide variety of guitar types. Although steel strings are the most widely played, nylon-string guitars are often heard in contemporary music. In addition, the paired string design carried over from the 15th Century can be seen in modern 12-string guitars. Countless variations in materials, strings, picks and playing styles produce a multitude of different possible sound fashions. It is thus important to know how each of these factors influences the overall sound and how to use this to your advantage.

The overall type of guitar has the largest bearing on the sound produced. Steel string acoustics are characterized by a full, rich sound that emphasizes bass (low end). Examples of this can be heard in Pink Floyd's "Mother" and Pearl Jam's "Daughter". On the other hand, a nylon string (classical) guitar accentuates treble tones and generates a plucking sound. Pieces by Santana and Spanish folk bands have a distinct nylon factor in their style. Twelve string guitars, which can have nylon or steel strings, have a different sound altogether. In standard tuning, four of the 12 strings are tuned one octave higher than their paired counterparts, while the other two have identical tunings. The result is a tone that sounds like two guitars playing in unison, as heard in The Beatles' "Help!"

A poorly manufactured acoustic guitar or the wrong equipment can even nullify a talent like Eric Clapton's

An acoustic guitar's sound is also heavily reliant on its body material. It may be composed of numerous combinations of materials, all of which yield their own unique tones. Acoustic guitars have traditionally been made of several different types of wood, including spruce, cedar, mahogany and rosewood. The body is usually composed of two types of timber. The top may be made of either spruce or cedar. A spruce top yields a bright, lively sound while cedar produces a dark, mellow sound. The rest of the body may be composed of mahogany or rosewood. Although mahogany is the cheaper of the two, it does not produce the same volume of sound, balance or fullness (warmth) of tone that rosewood is known for. The back and sides of the body are often laminated for scratch resistance, though this does diminish the tone slightly. New breakthroughs in materials have led to the use of carbon graphite, which makes up the entire body of some newer models. While carbon graphite guitars are less expensive than their wooden counterparts, the quality of their sound is noticeably inferior.



Source: Shawn Enright

A bridge must be mounted correctly onto a guitar so that it can withstand the tension of the strings.

A more easily adjustable sound factor in acoustic guitars is the type of strings used.

The popularity of steel string acoustics has yielded an extremely diverse selection of steel strings. To put this selection in perspective, there are over two dozen major guitar string manufacturers. Each of these fabricates strings with several different manufacturing techniques, such as polymer coating, cryogenic treatment and traditional fabrication. Each of these manufacturing categories is further divided into different string compositions involving bronze, nickel and pure steel. Each of these materials is then subdivided into a wide range of gages (thicknesses). Acoustic string gages can range from extra light (.010-.048 millimeters) to medium (.013-.056 millimeters) with several gage classes in between. Without even doing the math, it becomes obvious that there are literally hundreds of string types from which to choose. Such a wide variety can lead to confusion when choosing a set of strings, but knowing a few basic guidelines alleviates this.

Multiple manufacturing techniques exist to support different playing styles; each style has its own effect on how long the string retains its tone and tuning. "The manufacturing techniques used in most of these strings really don't affect the overall sound," says Jason Sheridan of Ward-Brodt Music. "They're more aimed towards giving the string a longer lifetime." The polymer coating technique (employed by Elixir Strings) does this by insulating the metal from substances on the fingers of the player, such as dirt and acid, which prematurely age the string. Cryogenic string treatment (pioneered by Dean Markley) realigns the string at the molecular level, allowing for longer lasting tone and ability to stay in tune. While both of these types of strings are favorites of guitarists with a vigorous playing style, they also carry a higher price tag (one to three dollars more) than traditional strings.

The popularity of steel string acoustics has yielded an extremely diverse selection of steel strings....there are over two dozen major guitar string manufacturers

Though string-manufacturing techniques do not influence the overall sound of an acoustic guitar, string materials do. Guitarists select strings that highlight the type of music they play, and knowledge of the effects of different materials is important in making a decision. For example, the most popular acoustic strings are composed of steel and bronze or phosphor bronze, which yield a warm rich sound. Steel strings with nickel plating (more commonly used in electric guitars) offer a good midrange tone, while pure steel strings produce a brighter, treble-laden sound. Pure nickel strings present a smooth vintage sound that can be heard in popular 60's rock music.

String gage is another important factor in sound. "Basically, higher gage equals louder sound and longer life," Sheridan explains. "A lot of rhythm guitar in heavy metal uses high gage strings. The problem is, heavier strings can be hard to control, because their added bulk requires more finger strength to play them." Strings for acoustic guitars do not rise above medium gage, as the tension associated with thicker strings can warp the guitar's neck. In acoustic music involving rich, bass-defined tones, medium gage strings are the correct choice. Lighter strings are used in brighter music and when playing fast solos (the opening riff in Tantric's "Breakdown" is a good example).

A sound-influencing factor that goes largely unnoticed in the realm of acoustic guitars is the type of pick used. Like strings, picks come in a wide variety of materials, sizes, thicknesses, shapes and colors. Some guitarists use other objects in place of picks as well, including coins, cards and their fingers, each creating their own unique sounds. Pick thickness has a large effect on volume. As Francesca Moore of Ward-Brodt Music explains, "Thick, heavy picks definitely give you a louder sound, but thinner picks sound more articulate." As with the guitar body and strings, composition makes a difference in picks as well. The two most common materials used in picks are nylon and tortex. Nylon picks generate a well-defined tone, but they introduce a "clicky" sound that discourages some guitarists. This clicky sound is not heard as much with tortex picks, but the downside is that some of the tone quality is undermined. Some picks are made of metal as well, and these produce tones similar to nylon's. Some guitarists prefer metal picks (and in rare cases coins) because they allow for the creation of certain effects, such as pick scraping (Adam Jones does this throughout Tool's "Merkaba"). Finally, some players abandon picks altogether and simply use their fingers. Finger style playing doesn't involve any of the clicky sound generated by picks, but the sound volume is significantly diminished. In addition, picking one string at a fast rate becomes difficult.

The final factor that contributes to an acoustic guitar's sound is how the guitarist plays it. Experienced players know that striking notes at different points on the guitar can result in diverse tones. For example, strumming the strings near the bridge creates a higher, brighter tone. This tone becomes darker and deeper as the player strums nearer to the neck. This fact allows guitarists to strum and pick at different points on the guitar to generate the sound they deem appropriate to their music.

Overall, numerous elements are key to producing a good sound on an acoustic guitar, and many are highly controllable. Knowledge of how to take advantage of these elements plays a prominent role in producing good music. It is no coincidence that guitarists who play the best music know what makes their music sound good. It is all about making use of what is available and manipulating it in a favorable way. Knowing how to do this can be just as important as developing the skills of Jimmy Hendrix.

Author Bio: Aaron Bock is a senior majoring in Engineering Mechanics and Astronautics. He is also involved in the Technical Communication Certificate program. When he's not studying, he's usually playing one of his two guitars. He's no Kirk Hammett or David Gilmour, but he enjoys playing just as much as they do.

How did Guitars Originate?

The roots of modern acoustic guitars lie in 15th Century Spain. The first guitars were the size of a ukulele and strung with four pairs of silk strings. They first became popular during the Renaissance. During the Baroque period, the body size was increased, and six single strings replaced the four pairs.

WARNING!!
In light of the relationship between tension and string gage, never employ steel strings in a nylon string guitar. The tension associated with steel strings will literally rip it apart.

The Flying Badgers Get Weightless

Source: Gabe Hoffmann

Team members in KC-135a Hanger at Ellington Field, TX. From left to right, top row: Katie Plzak, Jeff Johnson, James Diebel, Kyle Larson. Bottom row: Keith Tschohl, Gabe Hoffmann, Ryan Curtiss

By Tim Reppe

Zero gravity is a topic that has traditionally been limited to high-level NASA scientists or big-budget Hollywood movies. In April, however, James Diebel, Jeff Johnson, Katie Plzak and Kyle Larson of the UW-Madison Flying Badgers team defied this trend by conducting their own fuel droplet vaporization experiment aboard an advanced aircraft capable of producing a weightless environment.

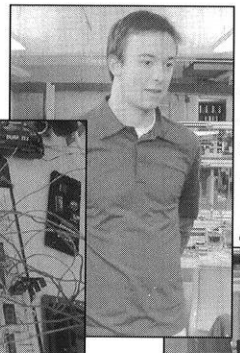
NASA's Reduced Gravity Student Flight Opportunities Program (RGSFOP) enabled them to conduct the experiment. This program, established at the Johnson Space Center (JSC) in Houston in 1997, funds such research. Students from around the country typically submit 20-page proposals that include explanations of their experimental theories and procedures.

Although NASA funds the flights, it does not directly benefit from the experiments. In other words, projects are not necessarily relevant to the space program. The Flying Badger's project, for example, deals with a process in common diesel motors. At supercritical conditions (high pressure and temperature), droplets of fuel are vaporized due to convection and diffusion. Fuel efficiency is strongly related to the completeness of vaporization. The intent of the research was to determine the extent to which diffusion affects the vaporization of fuel droplets. This was done by eliminating convection while vaporizing at zero gravity.

This condition was obtained by conducting the experiment aboard the KC-135a Reduced Gravity Laboratory, otherwise known as the "Vomit Comet". This plane, the same one that flew the cast of the movie Apollo 13, was built especially for producing zero gravity. The KC-135a creates such conditions by flying 30 consecutive parabolas, each one allowing 25 seconds of weightlessness. The deceleration of the aircraft's ascent as it begins turning in the parabola is the cause for the loss of gravity. This deceleration is similar to that experienced when a rising elevator comes to a stop. These flights take place over the Gulf of Mexico to avoid bothering neighbors on land.

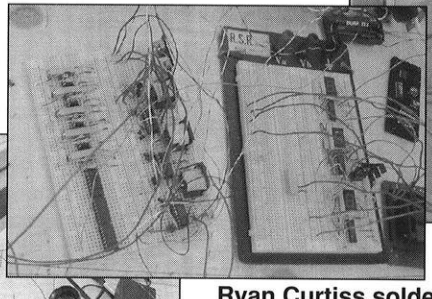
Gabe Hoffman, a first-year graduate student, has been working on various RGSFOP projects since 1997. In 1999, Hoffman was one of 3 sophomores working on the Sonic Bot project. The Sonic Bot was a rover propelled with sonic pumps. The purpose of the experiment was to test the propulsion device without gravity's influence. The advantage of a rover over a robot attached to the frame of a spacecraft is that it can attain precision positioning, as it avoids the vibrations of the spacecraft.

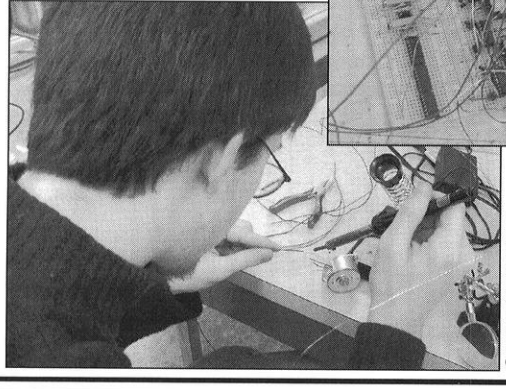
As part of the Sonic Bot project, Hoffman had the opportunity to fly on the KC-135a. Before entering the plane, Hoffman received a week of training known as Disorientation. The Disorientation program serves to prepare one's stomach for weightlessness, although most first-time fliers still lose their lunches. As Hoffman describes it, "Zero-G gives you the same feeling as when your stomach drops out going over a short bridge, or on a roller coaster – except it keeps on dropping."



Source: Jen Rowland

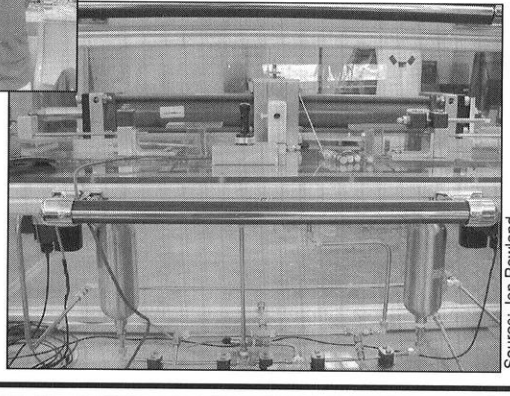
Games Dibel (left) explains how the vaporizer works: a fuel drop enters into the vaporizing chamber (below) from the left. A piston on the right heats and pressurizes the drop chamber to simulate diesel engine conditions.





Source: Jen Rowland

Ryan Curtiss solders wires together for the Zero-G vaporizer (left) which relays information to the data recording sensor (above).



Source: Jen Rowland

Once the Vomit Comet is flying in a parabola, the experiment only takes a few seconds. The remainder of the flight is open for free time. Hoffman mentioned that the scientists at JSC give suggestions for free time activities. On his flight, he chose to duel one of the senior scientists in a superman race, a weightless swim across the cabin of the KC-135a.

The most recent project for the Flying Badgers was in progress for two years. The project was supposed to be submitted last spring, but it was postponed until March 18th of this year because of time constraints. In February, the team submitted a Test Equipment Data Package, a description of how the hardware works. Once the experiment was completed, a detailed 50-page description of their results was prepared by May.

The Flying Badgers are a team of approximately 20 Madison students of all ages and disciplines. The team receives advising from Michael Corradini, the former assistant dean of engineering, but is mostly a student-run organization. This year, the number of students on the team has increased four-fold. This growth is the result of an improved effort in advertising, mainly through departmental e-mails.

"[The Zero-G Project] has also taught me valuable lessons about every aspect of organizing and successfully carrying out an engineering research project."
- Katie Plzak

The Flying Badgers fund their research with the support from many interested organizations. The Engineering Physics, Chemical Engineering, Mechanical Engineering and Electrical & Computer Engineering departments, as well as the Wisconsin Space Grant Consortium have collectively provided over $20,000 for the current project.

The Flying Badgers are always recruiting enthusiastic students who are fast learners and self-motivated. Interested applicants need not be majoring in engineering mechanics or have a desire to join the aeronautics industry. There are many areas in which to get involved, including electronics, communications, marketing and business.

The overall goal of the RGSFOP is to broaden learning through experimental design and analysis. NASA requires that participating students present their projects to local schools. The Flying Badgers presented to John Muir Elementary in April.


Source: Gabe Hoffmann

Flying over the Gulf of Mexico in the KC-135a, Kyle Larson, Katie Plzak, and Ryan Curtiss (counter-clockwise from left) experiment in the Zero-G environment.

For many students on the team, like Katie Plzak, independent learning is their favorite part of the RGSFOP project. She is eager to learn about the science and spread the message of the rewards of independent research.

In her words, "Not only has this project given me a chance to see how material I learn in class applies to real engineering problems, but it has also taught me valuable lessons about every aspect of organizing and successfully carrying out an engineering research project."

For more information on the Flying Badgers, visit: *http://www.cae.wisc.edu/~floatn/*

For more information on the Vomit Comet, visit: *http://jsc-aircraft-ops.jsc.nasa.gov/kc135/*

Author Bio: Tim Reppe has written articles for the Wisconsin Engineer for one semester. He graduated in May with a degree in Chemical Engineering and is seeking employment in Minnesota.

Flying to New Levels of Safety

By Mike Czaplewski

A man named Bill enters the airport with his three screaming children and has to stand in a mile-long line just to get his ticket. Once Bill gets his ticket he has to enter the security line, which is even longer. Bill has to stand in these long lines because of what took place on September 11. After the terrorist attacks, airports made more of an effort heighten security.

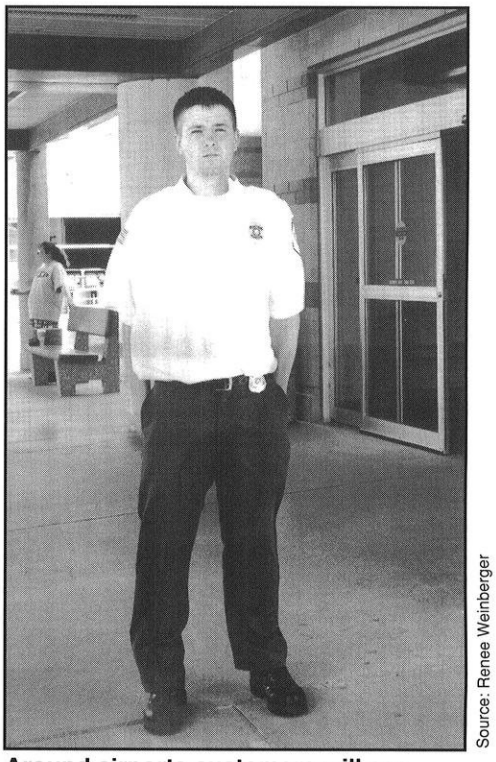
The changes started on February 18, 2002, when airport security was placed under the control of a new federal agency, the Transportation Security Administration. This new federal branch has the power to control the screening of passengers, patrol airport grounds and arrest rule breakers. It also controls the business aspect by hiring and training the people they want and working with other federal, state and local agencies.

Before the new agency had a chance to officially take over, the FAA started the upgrade of security by buying certain products for airports throughout the United States. They are working with InVision Technologies, Inc., the market leader in explosive detection systems that scan luggage. The San Francisco Airport recently ordered $13.7 million worth of detection systems. The company also received a $169.8 million order from the newly empowered Transportation Security Administration for 100 explosive detection systems and kits that would allow airports to build 300 new systems.

Airports are not just buying products from other companies to heighten security; they are also inventing their own technology.

The United States is not the only country buying security products. InVision Technologies has many other million-dollar orders from international airports. Since September 11, the company's stock has leapt from $3.11 to $40.95 per share.

The specific explosive detection systems the government bought from InVision Technologies were the CTX 5500 DX and CTX 2500 models. The CTX 5500 DX has a conveyor belt that moves bags through the machine while the system takes a scan projection X-ray. The computer then determines which pieces of luggage need further investigation, and an X-ray takes a more detailed "slice" (computer tomography, or CT) image of the luggage. InVision says, "Using sophisticated algorithms, the system analyzes these 'slice' images and compares their CT properties with those of known explosives." If they match, an alarm sounds and the screen on the computer identifies the luggage with the explosives.



Source: Renee Weinberger

Around airports customers will see more security.

The CTX 2500 scans luggage the same way as the CTX 5500 DX, but it is portable. Its portability makes it ideal at not only airports but also seaports, postal facilities and border crossings. It differs from the CTX 5500 DX in that it can detect illegal drugs, flammables, hazardous materials and other contrabands.

Another company that may also see more business soon, if the Department of Justice decides that stun guns are acceptable in the cockpits of airplanes, is Taser International, Inc. Athough the Department of Justice has not publicized its decision, United Airlines has already purchased $1 million of M-26 stun guns. The M-26 can fire two five-second electronic charges that disable attackers for 30 seconds to a few minutes. Taser International's stock price has rocketed from $6.80 to $17.70 since September 11. It may increase more if the Department of Justice approves stun guns.

Airports are not just buying products from other companies to heighten security; they are also inventing their own technology. The new Computer Assisted Passenger Pre-Screening System (CAPPS) would mark passengers' tickets as either "selectee" or "non-selctee", based on conduct, appearance and past problems they may have had with

Source: Renee Weinberger

Signs at security checkpoints inform passengers of the new security procedures.

people. This process will allow security to focus its attention on the selectee group while the majority of the passengers proceed through the normal security procedures. The selectee group will go through the same security checkpoints as the non-selected group, but they will also have their belongings searched.

One problem with the CAPPS system is that most airports are set up for quick check-ins at the boarding gates for people with no luggage. Airlines estimate that 40 to 80 percent of people proceed directly to the boarding gates without checking luggage. The changes would force everyone to check in at the check-in counters whether or not checking a bag. The result: longer lines.

Changes are not confined to equipment. The airport's operation itself is being altered. The government would like local police departments to be more knowledgeable about the airport's equipment, operations and personnel. Airports also want the local police to be more involved in security. Airports are going to hire senior level security officials who will have a very high level of security clearance. These changes will help make sure that if a serious situation presents itself, it will be taken care of with swift and decisive action.

Source: Renee Weinberger

With all the new measures of protection that are being implemented passengers may have to wait a little longer in line.

All of the changes the government has recommended and put into action should make passengers and employees safer. With time, Bill and his kids will see that they can proceed quickly through the airport because the long lines have been eliminated. In the words of the comedian Lewis Black, the airports may not be any safer, but they sure are slower—which makes people believe that they are safer. All joking aside, even though it may be slower, only time will tell how much safer these changes have made airports.

Author Bio: Mike Czaplewski is a sophmore from Naples, Florida, who plans to pursue a degree in Mechanical Engineering.

Why You Should Tune Into

91.7 FM WSUM

By Justin Novshek

After many years and a court battle, UW Madison student radio finally went on air earlier this year. Formerly only available as a web radio station, WSUM can now be found at 91.7 FM. This also ends UW-Madison's position as the only Big Ten university without a student radio station.

WSUM offers a wide array of programming by college students, for college students. It offers programming for any taste, including jazz, rock, classical, country, techno, and others. However, there is an emphasis on genres under-represented elsewhere on the radio. Check out their website at **www.wsum.wisc.edu** and see what they have to offer.

Radio Shows

"Jazz Wake Up"-hosted by Eitan Silver and Mitch Robbins. While the DJ's strive mostly to provide the upbeat jazz in the morning, the show also offers interviews and music by local musicians.

"Rancid Coffee Beans"-hosted by Temra Costa. Political commentary with a twist. Listen to current events, music and hear a great featured artist from Madison do his/her own thing each and every week!

Zac Tajin demonstrates how some of the recording equipment works.

Below: DJ Anna Filipek announces the last song played on her show, *Robot Parade.* The show features pre-sellout Ska, Punk, and similar music. Her co-host, Carolyn Burne, is not pictured.

Left: This is just one row in their music library. The collection is extensive, ranging from ABBA to ZZ Top.

Bottom:The student radio group has collected a large number of records in its 50 years of existence. While they have mostly switched over to CDs, occasionally they play a record on air.

Programming director Jake is hard at work in the studio. His job is to schedule all of the shows that the station has. He is also one of the most senior members, having been with the station for three and a half years.

Sample Playlist

- Jerry Garcia & David Grisman
- Herbie Hancock
- Re-Birth Brass Band
- Soulive
- Ilse de Lange
- Smashing Pumpkins

The station's large music library allows them to cater to many musical tastes.

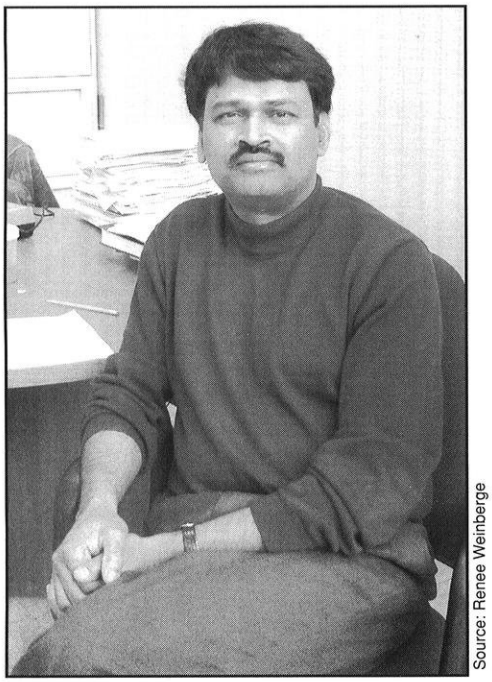
A Fishy Solution to Landfills

By Ellen Considine

Six years ago, Professor Srinivasan Damodaran of the UW-Madison Food Science Department took on the United States' third largest solid waste problem. He didn't open a recycling plant or tire retread facility; he developed a biodegradable hydrogel.

The American Heritage College Dictionary defines hydrogel as a "gel based on chemically linked water-swellable polymer networks." Most know it as the stuff in disposable diapers that somehow soaks everything up.

The first super-absorbent polymers (SAPs) were developed in Japan in 1978. SAPs, such as hydrogels, make parents' lives easier by freeing them from the hassle of cloth diapers. But by the mid-nineties, disposable diapers occupied half of the country's landfill volume. Moreover, the diapers weren't decomposing or compressing in the anaerobic landfills.



Source: Renee Weinberger

Srinivasan Damodaran's hydrogel may be a green solution to a messy problem.

Enter Professor Damodaran. He read about the diaper-landfill dilemma in newspapers. Having done his doctoral research on soy proteins - substances with super-absorbent potential - Damodaran wondered if biodegradable hydrogels could perform as well as synthetic hydrogels.

Source: Renee Weinberger

Can waste fish be used for diapers?

...by the mid-nineties, disposable diapers occupied half of the country's landfills.

Most hydrogels are made of polyacrylate, an engineered, synthetic substance with astonishing water absorbency. One gram of polyacrylate absorbs 400 grams of water and up to 35 grams of saline solution. Those little dinosaur sponges that magically grew when you put them in the bathtub contained polyacrylate.

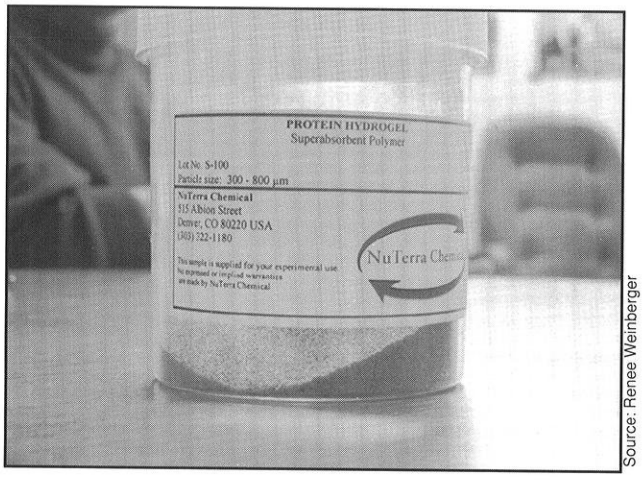
Polyacrylate molecules have carboxyl groups attached to them. Since the carboxyl group has a negative charge, it attracts polar water molecules. Up to seven water molecules can bind to each carboxyl group. As the dry polyacrylate powder absorbs water, it swells and turns into a gel. This is why your dinosaur sponge expanded in the bathtub and why polyacrylate works so well in diapers.

Polyacrylate was touted as a miracle of chemical engineering. But danger lurked behind the Huggies disposables. During the 1980s, sodium polyacrylate, the SAP used in diapers, was linked with Toxic Shock Syndrome and discontinued as an absorbent in tampons. Then its inability to decompose was discovered, giving more ammunition to the cloth diaper crusade.

Environmental concerns notwithstanding, the convenience of disposable diapers was unbeatable. No one was going back to cloth, and landfills were quickly filling.

But a natural, biodegradable hydrogel could lessen landfill stress, and Professor Damodaran had an idea. The soy proteins he had developed contained polyanionic polymers, negatively charged molecules like those in polyacrylates. But soy proteins weren't as absorbent as the synthetic SAPs. So Damodaran added EDTAD, the reactive, anhydride form of EDTA, an FDA-approved food and cosmetic additive. By attaching EDTAD to the soy protein polymers, Damodaran increased the negative charge of the polymer, which in turn improved the material's water-holding capacity.

Soy-based hydrogels ultimately absorbed 300 grams of water and up to 22 grams of saline solution per gram. Diaper manufacturers wanted something more absorbent



Source: Renee Weinberger

In the jar is a sample of a soy-protein hydrogel. This dry substance could be put in a diaper to absorb liquid.

than Damodaran's soybean hydrogel, as Polyacrylate could absorb 400 grams of water and 35 grams of saline solution.

Then Damodaran happened to talk with a friend at the Sea Grant Institute about carp.

Carp. That smelly bottom feeder. German immigrants deliberately introduced carp, which is native to East Asia, to North America during the 1800s. Today many loathe carp. They churn up muck while feeding on algae and weeds, allegedly secrete a chemical that disrupts the mating habits of native species and smell bad. Adding insult to injury, there is no commercial market for carp, and fishers in Wisconsin aren't allowed to throw them back in.

"...you cannot ask nature to behave like what we create in the laboratory."

According to the Wisconsin Department of Agriculture, Wisconsin throws away 20 million pounds of carp annually. Two million pounds go to waste each year in Lake Koshkonong alone. But Damodaran had an idea for this renewable, protein-rich resource.

Unlike plant proteins, such as soy protein, animal proteins are rich in lysine, an essential amino acid with useful properties. Also, proteins from fish tend to be very large, with an inherently high water-holding capacity. Damodaran reports that, for hydrogel applications, "The physical properties [of fish polymers] are much superior to plant proteins."

As he did with the soy protein, Damodaran added EDTAD to ground fish. The EDTAD bonded to lysine molecules, creating three times the original negative charge and increasing the water holding capacity. Then glutaraldehyde was added, linking the protein polymers and creating a more rigid matrix and a stiffer gel.

The EDTAD- and glutaraldehyde-modified fish protein is a far more effective hydrogel than soy-based SAPs. Absorbing over 400 grams of water and 27 grams of saline solution per gram of hydrogel, fish-based hydrogels approach the synthetic hydrogel benchmarks of 400 g water and 35 grams of saline solution. Damodaran points out that "...synthetic materials are much more versatile. You can fabricate them the way you want, but you can't do that with natural polymers because that's what nature produces. We can just slightly manipulate it...you cannot ask nature to behave like what we create in the laboratory."

Even though fish hydrogels don't absorb saline solution as well as synthetics like polyacrylate, they are entirely biodegradable. Damodaran reports that composted fish hydrogel will decompose safely and completely in 28 days, while polyacrylate occupies landfill space for centuries.

Damodaran's procedure for fish protein-based hydrogels has been patented through WARF, and NuTerra Chemical in Denver has already begun production. But Damodaran does not expect to see fish hydrogel diapers in North America soon. These biodegradable diapers will cost 1-2¢ more per diaper than polyacrylate diapers. The difference seems small, but American consumers hesitate to pay an extra 30¢ for the already expensive 30-pack of disposable diapers. Damodaran anticipates that the "natural" hydrogel diapers will be first marketed in Europe.

Not only can Damodaran's hydrogel reduce landfill waste and utilize carp, it may also be used in cat litter, dewatering and soil remediation applications. While synthetic absorbents may be more effective absorbents, "natural" absorbents have a substantially lower environmental impact. Professor Damodaran suggests that "We may not have come to the stage of polyacrylates, but this is where society has to make a judgment."

Author Bio: Ellen Considine is a senior in Geological Engineering. Her mother still carries a grudge for all those cloth diapers.

Driving Emergency:

Do you know what to do?

By Jessica Olson

You will probably be involved in a car accident at some point in your life. If you have reached college and haven't had one yet, consider yourself lucky. In fact, according to the National Safety Council, one in every eight drivers will be involved in a motor vehicle crash this year. What should you do if you are one of these eight? It depends on the type of accident. For instance, you may have a collision, combustion, a blown tire or failed brakes. This article will look at what to do in these situations.

Auto Collision

The first thing to do when involved in a car accident is to move the car to a safe, clear place and stop the car. Next, the driver should turn off the car and check to see if anyone needs first aid. The police, and an ambulance if necessary, should be called. If debris is left on the road, flares or reflective triangles should be used to warn oncoming drivers.

Once the scene is safe, get the names of all people involved, including witnesses. Make a diagram on paper with the directions the vehicles were traveling and where each person was sitting when the accident happened. Also, note the time and date of the accident and whether it is raining, snowing, night, day or other conditions. Be sure to get the other driver's license number and insurance information. One important thing many people do not know is that the fault of the accident should never be discussed between drivers. When the police arrive, tell them exactly what happened and get a copy of the accident report from the local precinct.

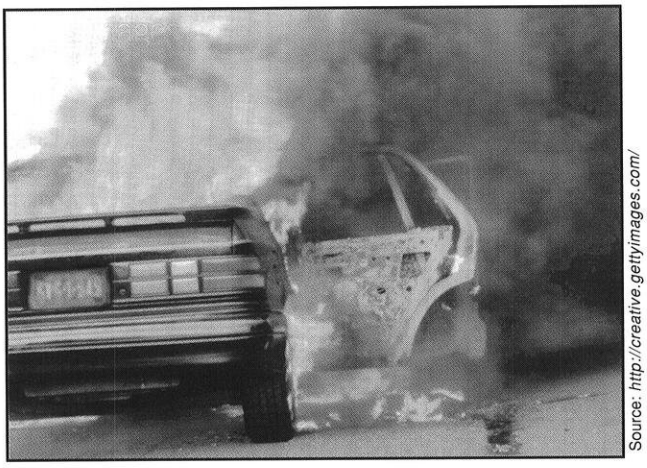
Deer Collision

Over 10,000 deer are killed each year because of car collisions [2]. This reflects only the number of accidents reported, which may be as little as one out of every five. It is important for people to know what to do in these situations. In some cases the deer runs off and the person and vehicle are in good condition, so the person drives off.

It is not against the law to leave the scene of a deer accident if no other drivers were involved, nor is the driver required to report the accident to the Game Commission [3]. However, if the deer does die and the driver wants to claim the carcass, the driver must call the Game Commission's region office in the county the accident occurred. The office will issue a free permit and the driver can remove the deer.

In the case where the driver leaves the scene, anyone else may claim the deer. This person must then contact the Game Commission within 24 hours.

If the deer is not killed, drivers should keep a safe distance from the animal. If the deer is in the road and may cause another accident, the driver should report it to the Game Commission or call the police department to have it moved.



Source: http://creative.gettyimages.com/

Never try to put a car fire out alone. The fuel tank could cause an explosion, as in this picture.

Auto Combustion

Car fires can start for many different reasons. They could start because of a gas leak that has gone on unnoticed or a blown engine. It is very scary to be sitting in a car when it suddenly ignites. The person driving the car needs to know what to do and move quickly.

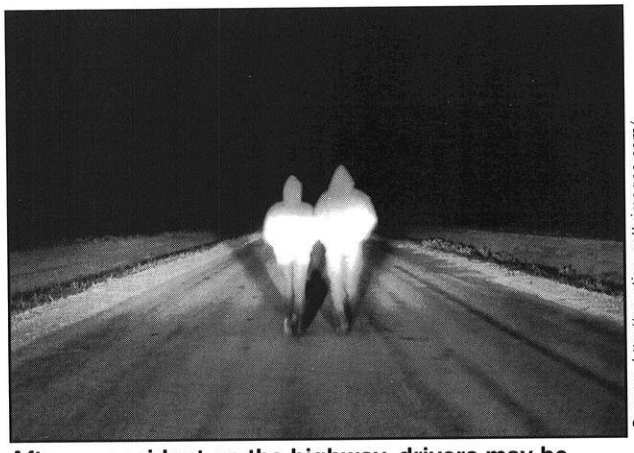
If the car is in motion when the fire is noticed, pull over as soon as possible. On the highway, signal and pull over to the shoulder on the right. Stop the car, shut off the engine and get everyone out of the car. Move far away from the vehicle and do not let any bystanders near it. If possible, warn other drivers by waving them away from the car. Finally, call the fire department as soon as possible. Never try to put the fire out alone, because the fuel tank may ignite and explode.

If you are in extreme traffic or an area with many pedestrians, these people need to be warned as soon as possible. When everyone is a safe distance from the vehicle, call the fire department. Always think about safety—do not put life at risk for material things.

Blown Tire

While driving down the road, a blown tire on the shoulder is not an uncommon sight. Sometimes skid marks or even a crashed car can be seen. This happens to all kinds of vehicles, new and old. Having a blowout while driving is a serious situation and how the driver reacts can mean life or death; one wrong move and a serious accident can occur.

The first thing to do in this situation is to grip the steering wheel tightly—it will be vibrating quickly and may be hard to control. Stay in the lane and get control. Do not instinctually slam on the brakes. Instead, remove your foot from the gas and slow down gradually. If the front tire blows, the



Source: http://creative.gettyimages.com/

After an accident on the highway, drivers may be forced to walk somewhere for help. They should stay off the road to avoid being hit by an oncoming car. Walking in a ditch or through a field is advised.

vehicle will swerve toward the side with the blowout. If a rear tire blows, the back of the vehicle will weave from side to side [4].

As soon as you have control of the car and it is safe to do so, try to pull over in the right lane or take an exit. If a lane change is necessary, do so slowly and carefully, and use signals. It may be necessary to go into a ditch to avoid being rear ended or running into another car. Once all tires are off the pavement, brake harder until the car stops. Be sure to get out of traffic before the car stops. Turn on the hazard lights and put up flares or other warning signals to alert other drivers. If the car is a safe distance from traffic and you know how to change the tire, do so carefully.

It is important in these situations that drivers do not put themselves in danger to avoid delay. It may be necessary to call professionals if traffic is too close. Finally, the car should be taken to a professional to ensure no other damage has occurred.

Failed Brakes

Having your brakes fail while driving down the highway can be a horrific experience. If you do not know what to do, you could be in big trouble. The most important—and perhaps hardest—thing to do is to stay calm. Get in the right lane and onto the shoulder or exit. If changing lanes, use the blinker and move slowly. After the car is in the right lane, turn on hazards. Allow the car to slow down by taking your foot off the gas and shifting the car into a lower gear. After the car is out of traffic, put the car in neutral and use the emergency brake to stop. If the emergency brake is also broken, try to rub the tires on the curb to stop the car. Get the car out of traffic before stopping to avoid an accident with oncoming traffic.

When the car is off the road and the passengers are safe, use flares or other warning signals to keep drivers away from the vehicle. Raise the hood of the car and tie something white to the antenna or hang it out the window so officials know help is needed. Move a safe distance from traffic and the parked vehicle and look for help.

The cause of the break failure may be unclear. If the parking brake was left on while driving, this would have caused the brakes to heat up and the braking fluid to boil. In this case, after the car has a chance to cool, the brakes should be fine. If this is not the case, the car needs to be looked at by a professional.

It is unsafe to walk along the highway, so other ways of contacting help such as a cell phone or having another vehicle go for help is suggested. Most importantly, do not try to drive the vehicle; it must be towed and the brakes need to be checked.

Conclusion

In these situations, being prepared can make all the difference. A cell phone is always useful. Going over each step ahead of time will help any driver make the correct decisions in the event of an accident. Staying calm and acting deliberately instead of loosing control and slamming on the brakes is the best way to survive an emergency. WE

Resources:

UW-Madison Police Department
608-262-2957

UW-Madison campus Fire Department
608-266-4952

Dane County Department of Natural Resources Service Center
608-266-2621

Wisconsin Council of Safety
www.wsc.wmc.org

References:

1. www.wcs.wmc.org/facts/ontheroad/crashres.htm

2. www.oswegodailynews.com/conent/101600/101900car_deer_ax.shtml

3. www.paarshery.com/release36.html

4. www.kraftlaw.com/misc/firestonetires.htm

Engineering Construction Plan

By Nicholas P. Mueller

Editor's Note: *The following document and figure at right were procurred at great risk from the NPM construction agency, currently doing work on the Engineering Campus. This document reveals the master plan of all the construction.*

Engineering Campus Construction Plan, 2001-2010
Document: High Alpha Landplan
Form: 9000

--Begin Document--

Summary: Construction plans for the engineering campus.

This document refers to Figure "Poole-Bowman".

Primary goal: Recreate Engineering Campus to more accurately reflect progressive thinking and principles of efficient design.

Secondary goal: Annex grass infested areas and replace them with concrete.

Tertiary goal: Create more fountains, because we really need them.

1.This territory to be immediately annexed for construction of an additional fountain (incomplete). Large piles of dirt, multiple construction vehicles, etc., all necessary for extended periods of time (complete). Grass infestation removal key first phase (complete).

2.Large grass infestation. Annex territory for creation of concrete pill-box structures and monoliths of Steel and Progress (partially complete).

3.Small grass infestation. Annex for additional parking or small fountain (incomplete).

4.Large grass infestation. Recommend site for creation of small steel and concrete monoliths to fend off grass infestation (incomplete).

5.Rebuild Building 128, T-27 Motor Vehicle Lab (grid square H9) at first opportunity so that old campus maps are accurate (incomplete).

6.Annex Henry Mall territory for creation of additional fountain space (incomplete).

7.Large grass infestation detected. Recommend preemptive strike, followed by annexation for creation of additional Concrete and Steel monoliths (incomplete).

8.Annex grass space for creation of additional entrances to already labyrinthine CAE building (incomplete).

9.Clad Engineering Research Building (ERB) in Ivory (incomplete). Declare that the [now] Ivory Tower of Academia will stand against Sauron and his evil (incomplete).

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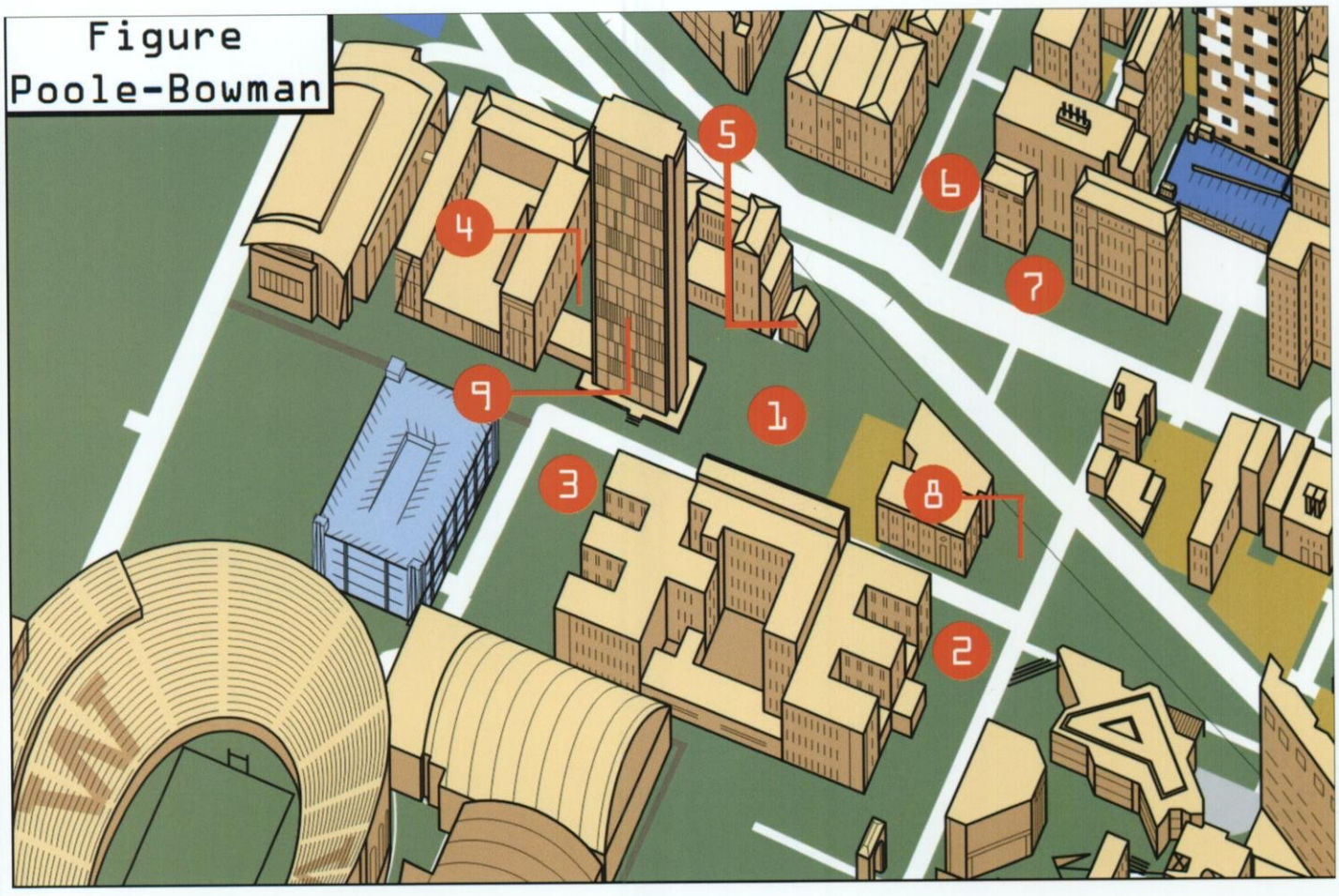

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Where do YOU fit in?

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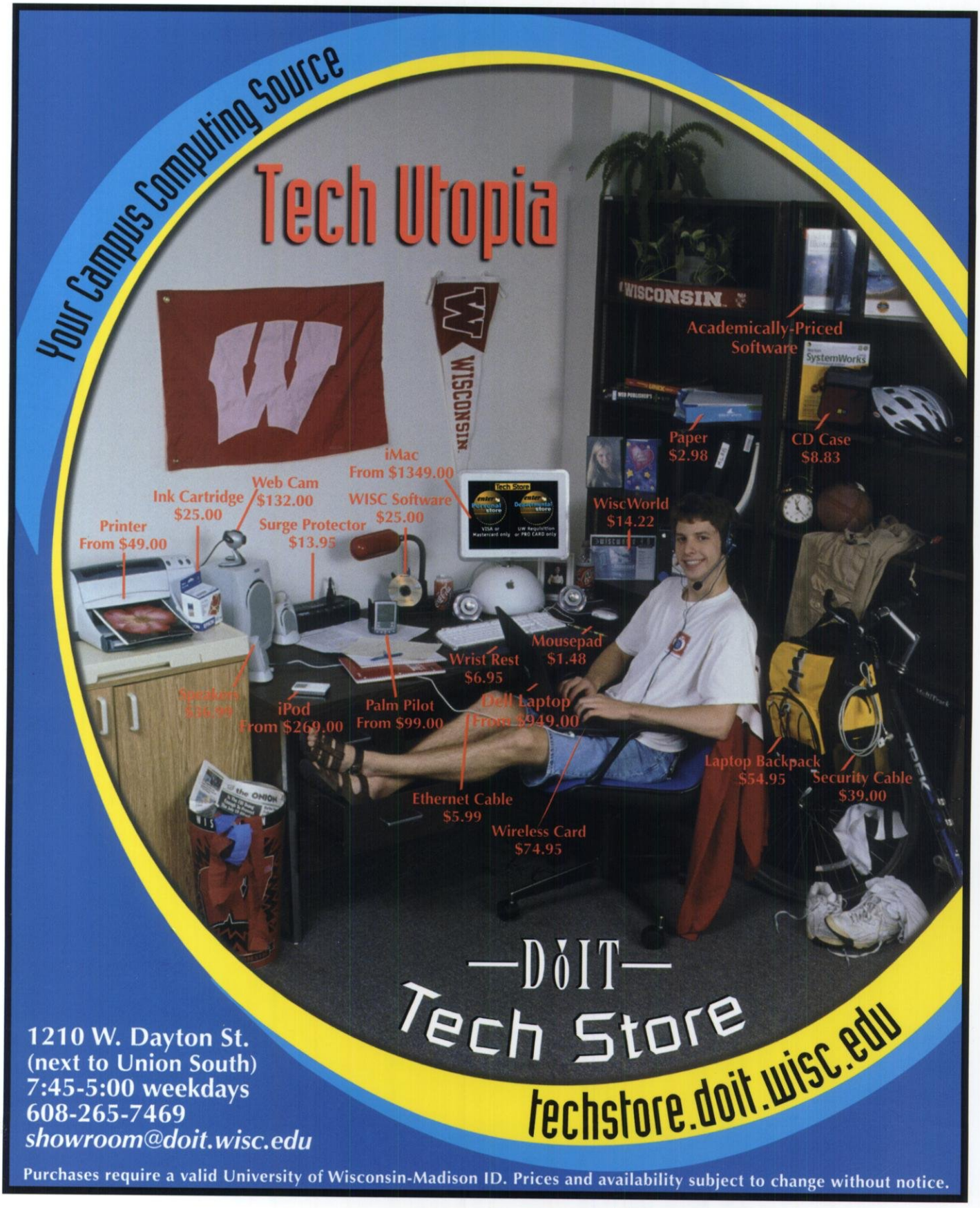
All majors are welcome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Palm Pilot From $99.00
Dell Laptop From $949.00
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7:45-5:00 weekdays
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Purchases require a valid University of Wisconsin-Madison ID. Prices and availability subject to change without notice.