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VOLUME 109, NUMBER 2

Nanotechnology on campus

Single electron transistors

UW's new nanotech research center

Engineering Expo 2005

wisconsin engineer

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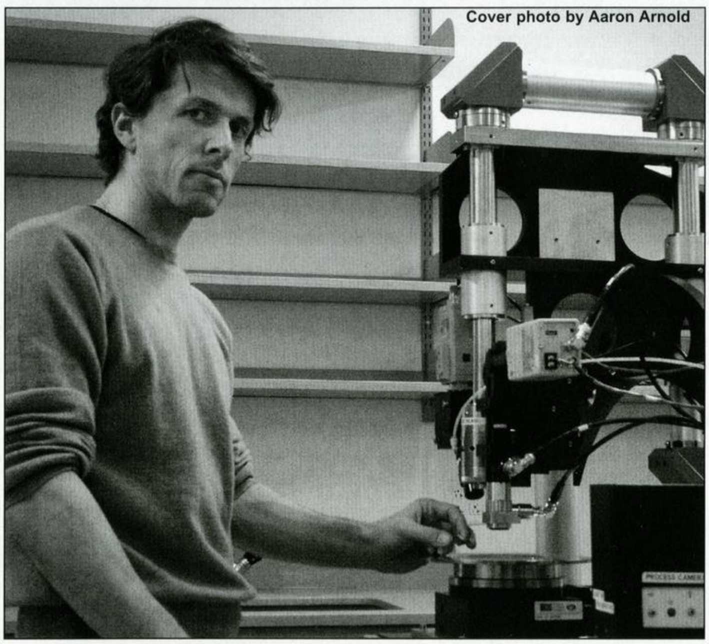

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Engineering reconstruction

The devastating effects of the Dec. 26 tsunami in Southeast Asia prompted worldwide action. Governments and private citizens combined to pledge about $3 billion in the two weeks following the disaster, according to the New York Times. President George W. Bush even called former presidents George H. W. Bush and Bill Clinton into service to help with fundraising efforts.

As all of this money began to pour in from throughout the world, many people started asking about how best to spend it. They were asking questions that usually arise when disasters strike: who is best equipped to provide relief under these circumstances, and who can put the money to good use the quickest?

In the coming weeks, though, policy makers will start thinking about the transition from short-term relief to long-term reconstruction. On Jan. 9, Secretary of State Colin Powell said he believed U.S. aid should be used "not just for immediate humanitarian relief, but for economic assistance, for infrastructure development." Hopefully other leaders will agree.

This reconstruction will be no insignificant task. Science policy researchers Daniel Sarewitz and Roger A. Lielke Jr. explained why on Jan. 7 in The New Republic Online:

"Disasters disproportionately harm poor people in poor countries because those countries typically have densely populated coastal regions, shoddily constructed buildings, sparse infrastructure, and grossly inadequate public health capabilities," Sarewitz and Lielke write.

Leaders will be doing a disservice if they think of reconstruction as merely restoring what was, until recently, the status quo in this region. As Powell suggests, they must instead focus on helping the people of Southeast Asia build the infrastructure they need both to weather future disasters and to improve their everyday quality of life.

Sarewitz and Lielke suggest this is a reasonable goal.

"Most tools needed to reduce disaster vulnerability already exist, such as risk assessment techniques, better building codes and code enforcement, land-use standards, and emergency-preparedness plans," they write.

Engineers can and should play a significant role in providing many of these tools. The American Society of Civil Engineers and Engineers Without Borders - USA have already pledged significant technical and professional support for the reconstruction effort. The other professional engineering societies should follow suit; nearly all disciplines have something to contribute.

The National Academy of Engineering will host a task force meeting on Jan. 27 to discuss how engineers can help in reconstruction efforts. If attendees are sufficiently ambitious--and if the government and private agencies overseeing reconstruction cooperate with them--then engineers will have the opportunity to serve a devastated population on a massive scale.

What more exciting and noble task could an engineer ask for?

Kyle Oliver

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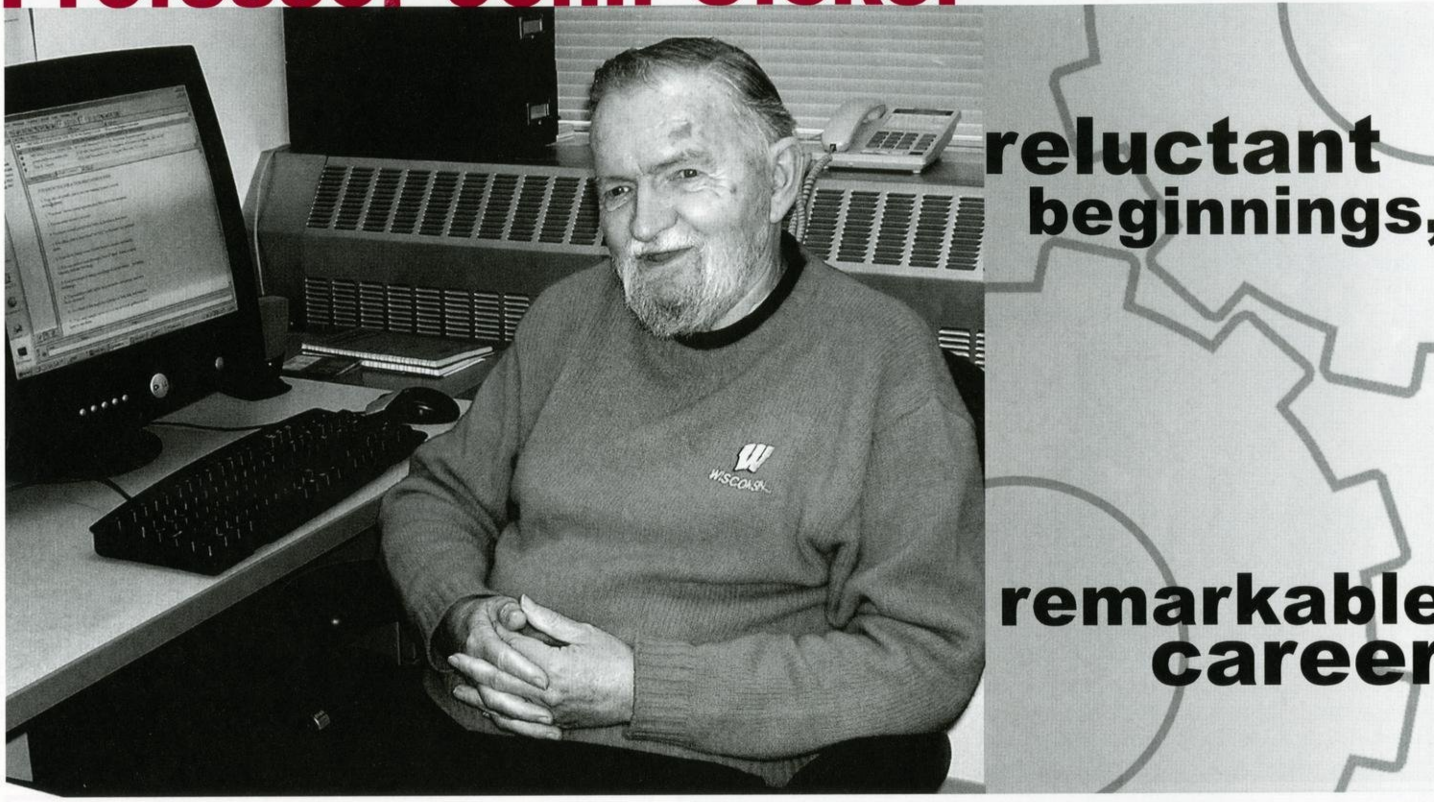
Photo by Carl Calhoun

Professor John Uicker



By Michelle Desnoyer and Dan Witter

Somewhere in a crowded office you'll find a Danish Modern Grandfather clock that once belonged to the Dean of Engineering of the University of Detroit. How did it get all the way to Madison? Was it part of a prank performed by an unruly undergrad? No, in fact, says the kindly gentleman who points at it with pride: "It was my father's."

Professor John Uicker both fulfilled and passed on the legacy of mechanical engineering that had spliced itself into his genes. With a father who was the Dean of engineering, and an uncle who was chairman of the board of a mechanical engineering firm in Detroit, growing up, Uicker did his best to avoid his destiny in engineering, but circumstances or fate always drove him back. Now, his interests pertain mostly to his career and keep him coming to his office at 4 a.m. every morning.

Uicker's undergraduate career began at the University of Detroit where he felt he was unjustly graded because of his father's position with the university.

"I'm still angry about three tests that I know were graded more harshly because of who my father was," Uicker reminisces.

When tempted to quit his early start in mechanical engineering, Uicker's uncle convinced him to take an aptitude test, betting his nephew five dollars that he was made to be a mechanical engineer.

"Five dollars in the 1950's was a lot of money, so I was determined to win it. For questions like: 'Would you rather be a garbage man or a mechanical engineer?' I would write down 'garbage man,'" Uicker laughs.

The test results came back, and Uicker was definitely meant to be an engineer. So he quietly returned to school and continued with his education.

At the time, during the height of the Vietnam War, Uicker was also involved in ROTC, so his main motivation for staying in school was to keep from being sent to war. After graduating from Detroit, Uicker would have been put on active duty had it not been for one of his professors who pushed graduate school applications on him. One of Uicker's applications was sent to Northwestern University, where the college of engineering was not impressed with his 2.95 GPA. Without telling him, the university called Uicker's father, who assured them that he would be a good student there. Uicker was granted a fellowship, and proved to be an excellent student after getting away from his father's influence.

The war still loomed on the horizon for Uicker, so he decided to continue his education with a Ph.D. After earning this degree, Uicker was finally called to serve. In 1965, the war was at its bloodiest, so Uicker expected the worst. Instead, he was stationed in Philadelphia, working for a mechanical engineering lab there.

After his two years were completed, Uicker was out of luck on the job search.

"One thing I knew for sure was I did not want to teach," he says.

Once again, his father helped him out with a book of all the mechanical engineering departments in universities across the country. Uicker decided to use these just to get access to a career services center. Tired of the busy cities he had spent his whole life in, Uicker was ready for a good university in a small town, where he planned only to teach for one year, and then find another job.

"That's how I came to Madison. It's been good to me," he says.

During that one year, Uicker found it "a joy working with young students," and a freedom he had never expected. He liked working with the students who had real experience working with machines and a genuine interest in discovering how things worked.

Coinciding with his professorship at UW-Madison, Uicker founded a cornerstone of the engineering program there. Always interested in computing since his undergraduate days, he was disappointed that the mainframe, located where the DoIT computer center is today, was used only for research, not teaching, and no state funds were allowed for computing. In an effort to change this, Uicker signed up for every computer committee he could find and started a movement for a computer used for teaching in engineering.

Through his work, Uicker and his colleagues acquired a computer from IBM from which he sold wires to other engineering departments. In a short time, with the money coming from other departments, the mechanical engineering department acquired a second computer to be used only for engineering purposes. This was the start of Computer Aided Engineering (CAE) which is now used by all the engineering departments as a special learning tool to help engineering students gain a better understanding of their fields.

Concurrent with the start of CAE, Uicker also assisted the dean of engineering at the time, Dr. John Bollinger, in starting a new masters program at the university: the manufacturing systems engineering program.

Photo by Noor Asyikin Rosli

As if starting a new program and CAE weren't enough, while working with a colleague on a computer program that would simulate the cooling of metal castings, Uicker became president of his own software company, as well as the first consortium in the college of engineering, what he considers one of his finest accomplishments.

"We got extremely lucky. . . maybe we were a little good," winks Uicker.

When teamed with Professor Richard Heine, who Uicker says "was a complete pleasure to work with," the two developed the software, with the help of several donors, that was later used to help the Wisconsin foundry industry. Heine, who is retired, still continues this work.

Out of all the things Uicker has accomplished, he considers the most important to be raising and sending all six of his children through college at UW-Madison. His eldest son is a mechanical engineer at the Advanced Vehicle Office at Ford. After Uicker's experience with his father as a professor over him, he was very sensitive about how his son would deal with having a father who is also a mechanical engineering professor at his school. Uicker also raised a daughter who went on to obtain a B.S. in Chemical Engineering and now works for Corn Products Corporation in Chicago, Illinois.

In a career that has spanned over thirty years here at UW-Madison, Uicker has been the recipient of many awards such as the 2004 ASME Mechanisms Committee Award, sat on numerous committees such as the Computational Geometry Committee and turned down offers for professorships at other schools including MIT, Stanford and Purdue.

"I wouldn't trade my career…for any other," Uicker says. WE

Author Bios: Dan Witter is a fourth year civil engineering undergraduate who is working with the UW Engineering Expo and the UW Construction Club in addition to the *Wisconsin Engineer.*

Michelle Desnoyer is a senior double majoring in english and political science.

THE ROAD TO SPACE TOURISM: ANSARI X PRIZE

By Edward J. Kim

It is Monday, Oct. 04, 2004, in the deserts of Mojave, California. SpaceShipOne has just brought an end to an eight-year, $10 million space race, claiming the Ansari X Prize. The team deliberately chose the October date because exactly 47 years ago, the Soviets put the world's first satellite, Sputnik1, into orbit - kicking off the first space race. SpaceShipOne rose to 377,591 ft., breaking X-15's record altitude of 354,200 ft. set in 1963.

The $10 million Ansari X Prize is awarded to one team among the most talented rocket experts in the world in a competition aimed at launching the space tourism industry. It was founded on May 18, 1996 in St. Louis by the X Prize Foundation. In 1995, Peter H. Diamandis established the X Prize Foundation with the assistance of Byron K. Lichtenberg, Colette M. Bevis and Gregg E. Maryniak. The mission of the X Prize Foundation was to create a future in which the general public would personally participate in space travel and its benefits.

The Ansari X Prize was inspired by the $25,000 Orteig Prize, which Charles Lindbergh won in 1927. Raymond Orteig, a wealthy hotel owner, offered the prize to the first person to fly non-stop between New York and Paris. Without any government support, Charles Lindbergh and those individuals who joined him in his vision formed the "Spirit of St. Louis" organization.

Using only the commercial technology available in his era, and outperforming the government with a small professional team, Lindbergh proved that long distance air travel was possible commercially. This triggered a series of events, building the basis of today's $250 billion aviation history. Following the historical steps, Alfred H. Kerth (The Secretary of Civic Progress) proposed to establish the "New Spirit of St. Louis" organization composed of 100 business leaders that would each contribute $25,000.

Charles Lindbergh won the Orteig Prize in 1927 by flying the "Spirit of St. Louis" across the Atlantic Ocean.

The Ansari X Prize guidelines were carefully created in cooperation with representatives from the Association of Space Explorers and the Ansari X Prize Committee. According to Diamandis, each rule was established for a specific reason. For example, one of the requirements is that the vehicle should be privately funded and constructed. This means the government cannot be involved in any of the team projects because its involvement would not lead to an economically viable tourist capability.

Others share the committee's concerns that this technology be economically accessible by more than just the government.

"The space industry is not being utilized much and it is such a shame that we cannot use it," Ryan J. Curtis, the president of the American Institute of Aeronautics and Astronautics (AIAA) chapter at UW-Madison, says.

The U.S. Air Force recognized the official 50 mile altitude as "worthy of astronaut wings." The 100 km altitude went beyond this level, but not beyond the exotic heat shielding required for reentry. The vehicle had to carry a load amount equal to three people in addition to a single pilot. Finally, the vehicle had to fly twice within two weeks to ensure it could fly again with minimal technical support.

Twenty-four teams from all over the world joined in the making of space aviation history. The winner and mother of SpaceShipOne, Mojave Aerospace Ventures, LLC, was among them. SpaceShipOne was built by the famed aerospace designer Burt Rutan, the team leader and founder of Scaled Composites. Paul Allen, a software billionaire provided the necessary financial support.

In June 2004, Mike Melvill flew the first mission to space, just barely reaching the required 62-mile altitude, passing the internationally known space boundary. He became the first person to fly into space in a privately funded aircraft. After a few modifications, Brian Binnie flew SpaceShipOne four months later to the finishing line of the X Prize competition. The trajectory of the space craft was beautiful, flying "as straight as an arrow" according to Gregg E. Maryniak, the Executive Director and Trustee of the X Prize Foundation. SpaceShipOne was the first privately built aircraft to go supersonic.

The aircraft consists of two vehicles, the WhiteKnight and SpaceShipOne. WhiteKnight carries SpaceShipOne up to an altitude of 46,000 feet and releases it. The released SpaceShipOne then ignites its Hybrid Rocket system, soaring up into the sky towards space. The incredible thrust is made possible by rocket fuel that Mojave Aerospace Ventures developed. It consists of tire rubber and nitrous oxide. According to Rutan, this fuel is a lot safer than the rocket fuels the government uses; hence, the Mojave rocket fuel minimizes the possibilities of the spacecraft exploding in mid-air.

A team of intrepid space travelers on SpaceShipOne claimed the $10 million space race Ansari X Prize in 2004.

Following this event, Richard Branson, who recently founded Virgin Galactic for the purpose of space tourism, announced a deal to license the SpaceShipOne technology. Using this technology, Branson plans to make suborbital space flights commercial by 2007, at a price of $200,000.

However, Virgin Galactic is not the only company en route to space tourism. Bigelow Airspace--a space station company founded by Robert Bigelow, the owner of Budget Suites of America--is hoping to build the world's first commercial space station. (So far, space travel has only been available to the public by the Russian Space Agency on its Soyuz ships, which charges $20 million per seat and requires six months of intensive astronaut training.) American businessman Dennis Tito became the first space tourist in 2001 through this program.

Altogether, less than 500 people have traveled into space, mostly astronauts and space scientists. James M. Lattis, Director of UW Space Place, believes that the X Prize will be the start of space aviation industry.

Sigurd De Keyser, administrator of the official X Prize Foundation Forum agrees.

"The X Prize has changed the opinion of many people that space is a 'very' expensive business and that only governments can reach space," De Keyser says. "[It] showed us you and I can fly into space in a few years from now." WE

Author Bio: This is Ed Kim's first semester writing for *Wisconsin Engineer*. He covered consumer technology for the magazine in the November issue.

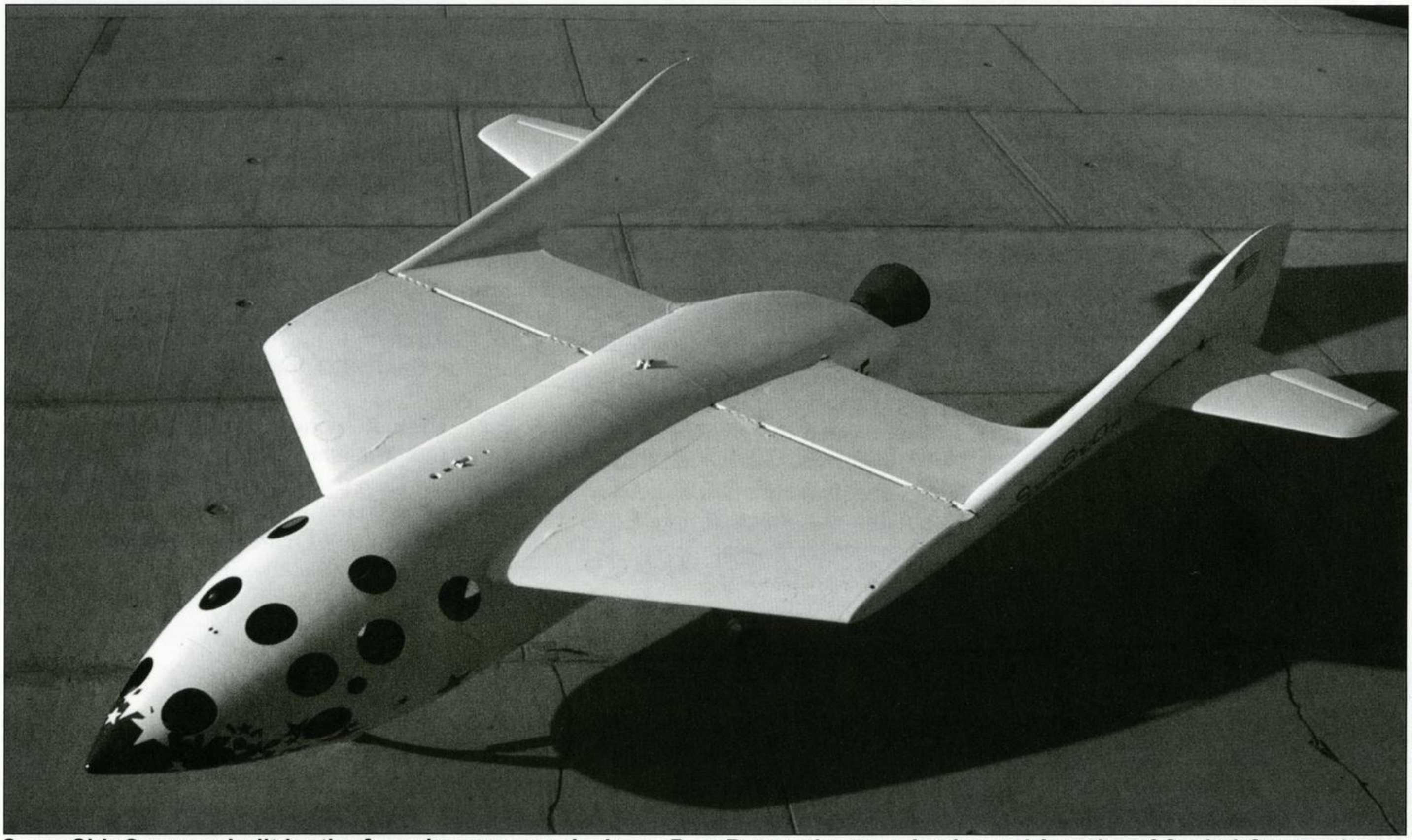


Photo by Justin Novshek

SpaceShipOne was built by the famed aerospace designer Burt Rutan, the team leader and founder of Scaled Composites.

HUGE possibilities for tiny technologies at new reasearch center

By Carly Mulliken

The faculty of the new Nanoscale Science and Engineering Center (NSEC) hope to discover harmony between different facets of the world.

The focus of nanotechnology, a comparatively new science, is to work on a small enough scale to find problems with technology that are hidden at larger scales. The scale that the scientists work at is measured in nanometers, or billionths of a meter. Put another way, a nanometer is 1/50,000 the width of a human hair.

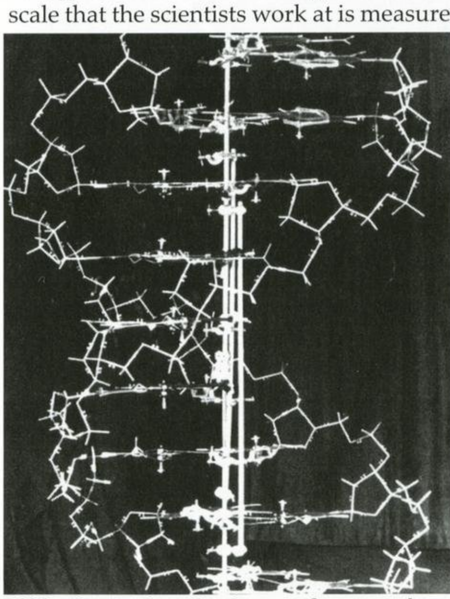


Photo by Jamie Tabaka

DNA, the molecular base of genes, has a width of 2 nanometers.

The new NSEC is not actually a building, so there is no single location where all of the research will take place. A grant given to UW-Madison by the National Science Foundation (NSF) will fund the administration of research projects proposed by the staff. The actual projects will take place in various locations on and near campus, including places like the Synchrotron Radiation Center (SRC) in Stoughton. The SRC houses much of the equipment needed for nanotechnology research.

Paul Nealey, the director of the NSEC and professor of chemical and biological engineering, is excited about the new technology that is formed through the study of properties at the nano level.

"Nanotechnology has great potential to transform many diverse areas of technology - from making faster and more integrated circuits, to building biosensors that detect chemical changes in the environment, to developing new classes of antimicrobial materials, to revolutionizing health care through decoding the human genome," Nealey says.

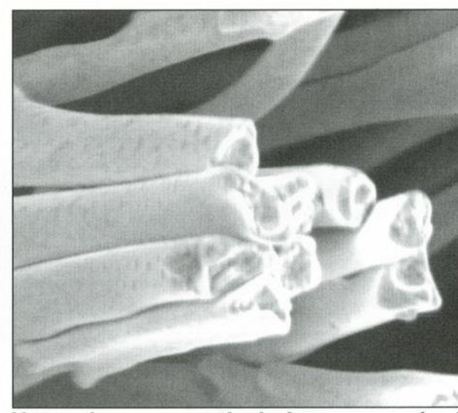


Photo by Jamie Tabaka

Nanowires currently being researched at the NSEC, magnified to nanoscale.

Through nanotechnology scientists find and understand the properties of tiny matter. Then engineers use this information to create new and superior products. The innovation of nanotechnology is the properties found on the small scale will provide information that can be transformed to improve the bulk product.

"One of the most exciting components of our NSEC [is] that it's on equal footing with the science and engineering," Nealey explains.

The center is staffed by faculty from different scientific and engineering fields who

"Nanotechnology has great potential to transform many diverse areas of technology."
-Paul Nealey

have come together to collaborate in researching this new science. The potential for interdisciplinary relationships formed through this process was actually one of the reasons the group was chosen by NSF. The staff hopes to continue UW-Madison's good track record for working together across disciplines.

Nealey and his colleagues say they wish to make the world outside of science and engineering, and most importantly K-12 students and their teachers, more aware of the new information found through their research. Their goal is not only to diversify the work force and provide new curricular material but also to make the public conscious of what the new technology can do.

"We know from past experience that it's no longer appropriate to pursue science without thinking about the societal implications at the same time," Nealey says.

The NSEC will form many relationships between previously separate aspects of nanotechnology. The center will supply a strong program for international collaboration with countries such as Australia, Switzerland and Argentina. The NSEC will also start a fellowship program which is able to pull qualified researchers from the U.S. and abroad.

Fostering the interaction of science and engineering is the basis of many of NSEC's goals. But Nealey and his colleagues hope not only to combine science and engineering but also to create a symbiotic relationship between society and the technology made possible by the center's findings.

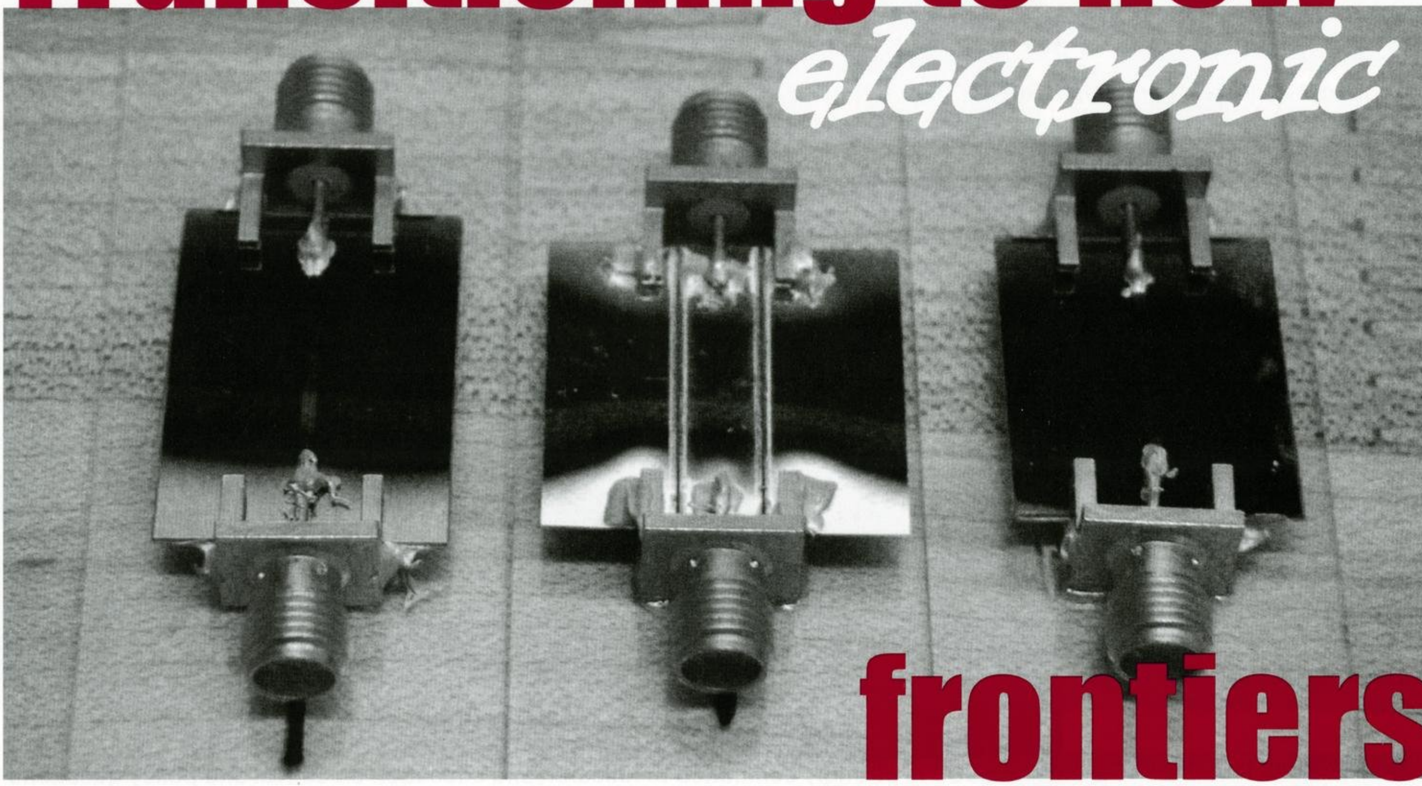
For more information on nanotechnology and the NSEC visit the following websites: www.nano.gov and www.nsec.wisc.edu. WE

Author Bio: Carly Mulliken is an english major here at UW-Madison. She is very excited to be working with *Wisconsin Engineer* for the second time on this issue.

Photo by Jamie Tabaka

UW's NSEC is strongly committed to research and education on ethical and policy questions associated with nanotechnology. Students in a new class on nanotechnology and society explore such issues as how the public engages with new nanotechnologies and whether nanomaterials pose novel health or environmental risks.

Transitioning to new *electronic* frontiers



By Michael Verner

Imagine being in a car accident in the middle of nowhere. No problem, just pull out your trusty cell phone and dial 911. But just as your emergency call is going through, your phone dies. Situations like this happen every day because power hungry phones devour their short batteries. However, such disasters could become a thing of the past thanks to new technology developed here at UW-Madison.

For consumers, this research will result in smaller and less power greedy electronic items.

Professor of electrical engineering Robert H. Blick developed what is called a Single Electron Transistor (SET) with his former graduate student Dominik Scheible. Tiny microprocessors and integrated circuits are found in all complicated electronics today, including cell phones and laptops. The most basic building block for these is the transistor. Your home computer may have millions upon millions of these tiny "switches" that make everything around them work.

Each switch works simply. It can either be turned on or off depending on the signal to be sent through. If the transistor is on, a voltage difference is applied between one end, called the "source," and the other end, called the "drain." This establishes an electric field, allowing electrons to flow from the source to the drain, causing a current. If the transistor is off, there is no voltage, no electric field and thus no current. A transistor turns on and off thousands of times every second, corresponding to the 1's and 0's of binary code, which operates computers.

Every time a transistor is turned on, the current flowing through it causes energy to be lost. This loss of energy not only shortens battery life, but dissipates heat, limiting how close together transistors can be placed on a chip. How will this new transistor change all this?

By using only a single electron flowing from source to drain instead of the thousands that create current in a regular transistor, the power loss is greatly reduced. Blick and Scheible were not the first to think of this idea - single electron transistors have been around for years. But none of the previous designs were able to be used in a practical way.

In older SETs, a conducting "island" was positioned between the source and the

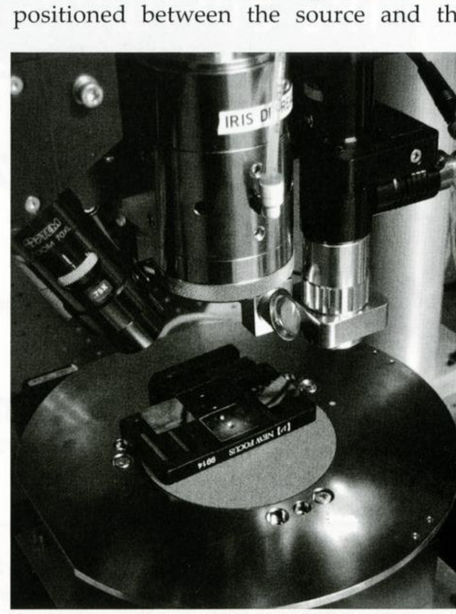


Photo by Aaron Arnold

Professor Robert H. Blick has developed a transistor that uses a single electron instead of thousands to reduce power loss.

drain. This allowed the electrons to jump from the source to the island to the drain, shortening the path required for current to flow. However, magnetic fields had to entice the electrons to move from one side to the other. The resulting drawback was that these SETs could only operate at superconducting temperatures, much too low for any useful purpose in consumer technology.

For UW-Madison, the effect is putting our electrical engineering department on the map.

In Blick's transistor, this "island" is connected to a tiny nanopillar which suspends it between the source and drain. When the transistor is turned on, the pillar begins to oscillate, much like a pendulum in a grandfather clock. The island moves towards the source until it is close enough that an electron can jump on. The electron is then shuttled across the gap until it is close enough to the drain to jump off. Best of all, this new mechanical model can operate at room temperature.

For consumers, this research will result in smaller and less power-greedy electronic items. For UW-Madison, the effect is putting its electrical engineering department on the map.

"This development could create new jobs for the city of Madison, as well as bring in new professors to the university," Blick says.

He also added that he's excited to be working with UW-Madison on this project and that they've been nothing but helpful. The university has helped him file for a patent and will be providing resources for Blick in the laboratory to further develop the transistor.

"At Wisconsin, I can consult with members in other fields because everything is so close together," Blick adds. "This way we can use this technology so it applies to their needs as well."

Being at UW-Madison has made it much easier to come up with new ideas, and Blick believes that this sort of thing will have a snowball effect.

"It's hard to get everything started, but once it does it will be tremendous for the university," he says.

Blick developed the device here in 2003, after several previous models created in Germany and brought here for study were destroyed. He related the experience to climbing a mountain. Finding a way up can often be difficult, and one often has to backtrack. But once he arrives at the top of the mountain he can look back down and realize what he should've done the first time.

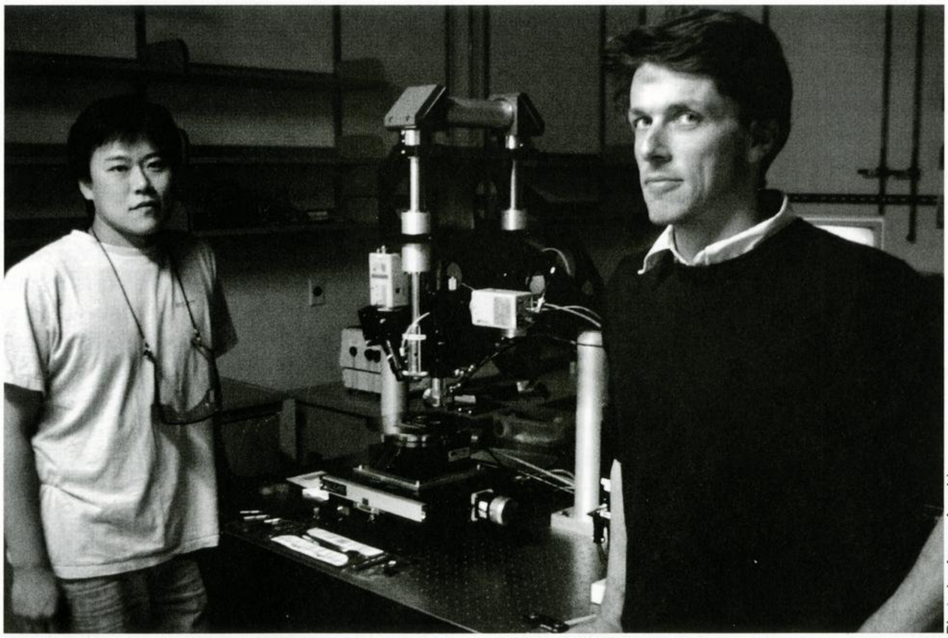


Photo by Aaron Arnold

Professor Robert H. Blick (right) and Dominik Scheible explain the concept of single electron transistors, which minimize size and power loss of electronic devices.

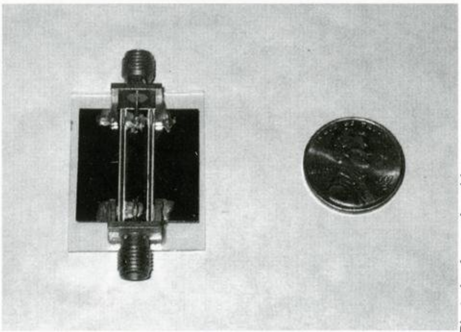


Photo by Aaron Arnold

Who says size matters? The new single electron transistor has impressive capabilities for being only as large as pocket change.

"It was the beauty and simplicity of the new design that convinced us of the merit of the mechanical approach," Blick says in a news release. "And then, of course, we were sort of mad at ourselves that we didn't think of it before."

The new transistor design could also lead to other developments besides increased battery life and smaller electronics. The "Quantum Computer," a hypothetical model that would operate at speeds thousands of times faster than today's computers, uses the idea of single electron transfer.

"One can execute the principle, but it's a very, very wild idea." Blick says, adding that many years down the road such a hypothesis could begin to be a reality. In the meantime he was more excited because "on the path to that, you can find many other useful applications."

Blick and Scheible's invention is sure to usher in more applications in the years to come, but for now they'll settle on its immediate uses. Still, it's hard not to get excited about the possibilities that lay ahead. WE

Author Bio: Michael Verner is a sophomore in electrical engineering from Eugene, Oregon. This is his second article for the *Wisconsin Engineer*.

DISCS of the future

By Sonny Suciawan

The Video Home System (VHS) is on its last legs and the Digital Video Disc also known as the Digital Versatile Disc (DVD) is fast reigning supreme. But what's in store for the future in home video entertainment?

A collection of electronic companies, including Sony and Samsung, have come together to create a new form of video and data storage known as "Blu-Ray Disc" (BD). On the other side of the fence, a group of companies, led by Toshiba and NEC are developing the High Density Digital Video Disc (HD-DVD).

BD? HD-DVD? What?

The BD was developed as a means to record High Definition Television (HDTV). HDTV is already well established in Japan and is beginning to gain momentum in the US. BDs can also double as a media for data storage, much like DVDs.

Photo by digitalhall.com

Prototype of the future from Blu-Ray Technology by Sony.

Originally, it was thought that BD would not be backwards compatible with DVDs and CDs, meaning that BD drives would not be able to play DVDs and CDs. However, recent announcements have vanquished these rumors and the BD drives are backwards compatible.

The HD-DVD however, was developed specifically as a successor to DVDs. It uses the technology similar to the one that DVDs use. This was to make the transition from DVDs to HD-DVDs seem like a natural move to a better version of a current media, rather than a move to a different format. The similar format will make manufacturing less costly and HD-DVDs are also confirmed to be backwards compatible.

What makes them…uh…tick?

The name "Blu-Ray" is taken directly from the blue laser technology that both of these formats employ. Currently, DVD drives use a red laser with a wavelength of 650 nanometers (there are 10^9 nanometers in a meter). The next generation disc drives will use a blue laser with a wavelength of 405 nanometers to read its discs. The shorter wavelength will add precision to the reading of the data in the discs. This way, more data can be stored and read on the discs. Although the two formats use the same reading technology, the data writing process is a little different.

The difference between the two formats is that HD-DVD retains a cover layer of 0.6 mm, like the DVD. On the other hand, BD utilizes a cover layer of 0.1 mm. A smaller cover layer basically translates into a larger amount of data that can be written on each disc.

Even though the BD has greater potential for data storage, the reduction of a cover layer will require a new manufacturing process. This will add cost to production and consumers will likely see it reflected in the price of the BD. Sony and the rest of the group, however, insist that they have come up with a solution to combat this higher cost and that manufacturing costs will stay down. In contrast, although HD-DVD will have a smaller capacity for data storage, the similarity of this media to the DVD will likely make it cheaper to manufacture. This will allow the HD-DVD to retail at a lower price point.

How much can I stuff in there?

Currently a single layer DVD can hold up to 4.7 GB (gigabytes) of data or about 2 hours of Standard Definition Television (SDTV). A dual layer DVD can hold up to twice that.

In comparison, a single layer BD can store up to 27 GB, 2 hours of HDTV or 13 hours of SDTV. A dual layer BD can store up to 54 GB of data, 4 hours of HDTV or 26 hours of SDTV. A single layer HD-DVD can store up to 20GB or 2 hours of HDTV and 30 GB or 4 hours of HDTV on a dual layer HD-DVD.

The smaller cover layer comes into play here, giving BD the bigger advantage in video and data storage. The developers of the BD are currently working on an eight layer BD, which at 25 GB per layer, could theoretically store up to 200 GB of data, larger than most hard disk drives in a PC.

Friends and foes

The war between the two formats is likened to that of Betamax and VHS in the early 1980s. Another split on media formats could be costly to the manufacturers of the less popular format and, more importantly, to the consumers who choose incorrectly. The only sure way to avoid these losses is for one side to win the battle before it even begins. This is the reason why both sides are trying to garner as many supporters from movie studios to back their media format as soon as possible. Lack of support from the entertainment industry could be the downfall of their respective formats.

As of October, 2004, Blu-Ray had obtained 30.2% of the market share with Sony, Fox and MGM on board with the BD as a media to distribute their home entertainment titles. Hewlett Packard (HP) and Dell also confirmed their support for the Blu-Ray format. Sanyo, Warner Bros, Universal and Paramount are likely to announce their support of Toshiba's HD-DVD format, allowing HD-DVD to acquire about 34% of the market share. However, Sanyo and Warner Bros have made it clear that they are not committed to one specific format and want to keep their options open to supporting either format. Microsoft and Disney are slated to announce their allegiance soon.

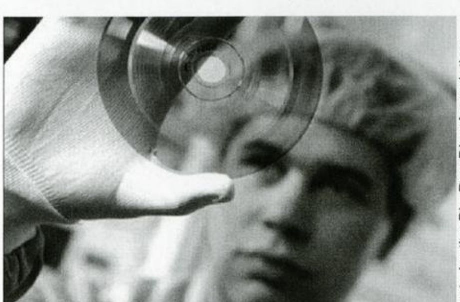


Photo by the Blu-Ray Disc Association

A Blu-Ray disc researcher inspecting a manufactured BD-ROM disc for errors.

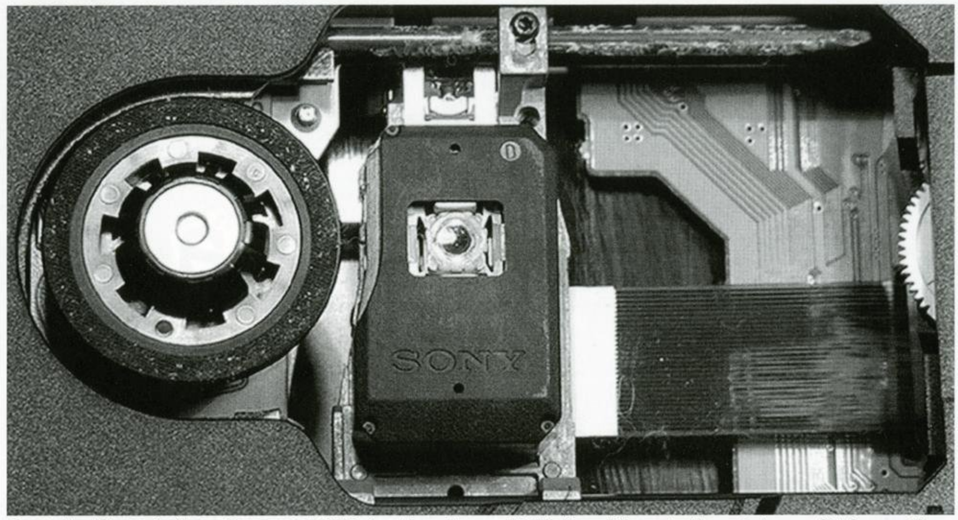


Photo by Kent Cutler

Sony's Playstation 2 uses DVD technology. Will the Playstation 3 benefit from the Blu-Ray Disk technology, and will Sony fix the dreaded "Disk Read Errors" that plagued gamers over the nation?

Other applications of both formats include the video gaming industry. Although, the Sony Playstation 2 and the Microsoft Xbox both utilize the DVD format in this generation, the next wave of video game console will be different. Sony has confirmed that its next console, the Playstation 3 will use utilize BD technology, while the Microsoft Xenon is expected to side with the HD-DVD. With such divided camps in so many facets of the entertainment media, this battle could turn out to be a bitter one.

"I've already put so much money into my DVD collection, and now they're going to introduce another media into the picture this fast?"
-Rifqi Hudaifah, UW student

When can I get my hands on one?

Two models of BD recorders are already released to the Japanese public. The Sony BDZ-S77 retails at 224, 000 yen (US$ 2050). The Panasonic DMR-E700BD is set at 214 000 yen (US$ 1960). In this stage of its life cycle, the Blu-Ray recorders are aimed towards businesses and enthusiasts, not the common consumer.

Meanwhile, HD-DVD has not made its debut yet. It is expected to do so in early 2005. Look out for an announcement soon from Toshiba and NEC.

As with any new technology, costs will be high in the introductory stages. However, as manufacturing processes improve and waste is eliminated from production, price drops are expected.

Blu-Ray or HD-DVD?

Rifqi Hudaifah, a UW-Madison student is concerned with the release of the two formats. "I mean, I've already put so much money into my DVD collection, and now they're going to introduce another media into the picture this fast? I'm worried that we may see a repeat of what happened to many consumers a couple of years back. In an attempt to upgrade their movie collection, many people had to repurchase some of the movies they already own on VHS and sell their VHS tapes dirt cheap," Hudaifah says.

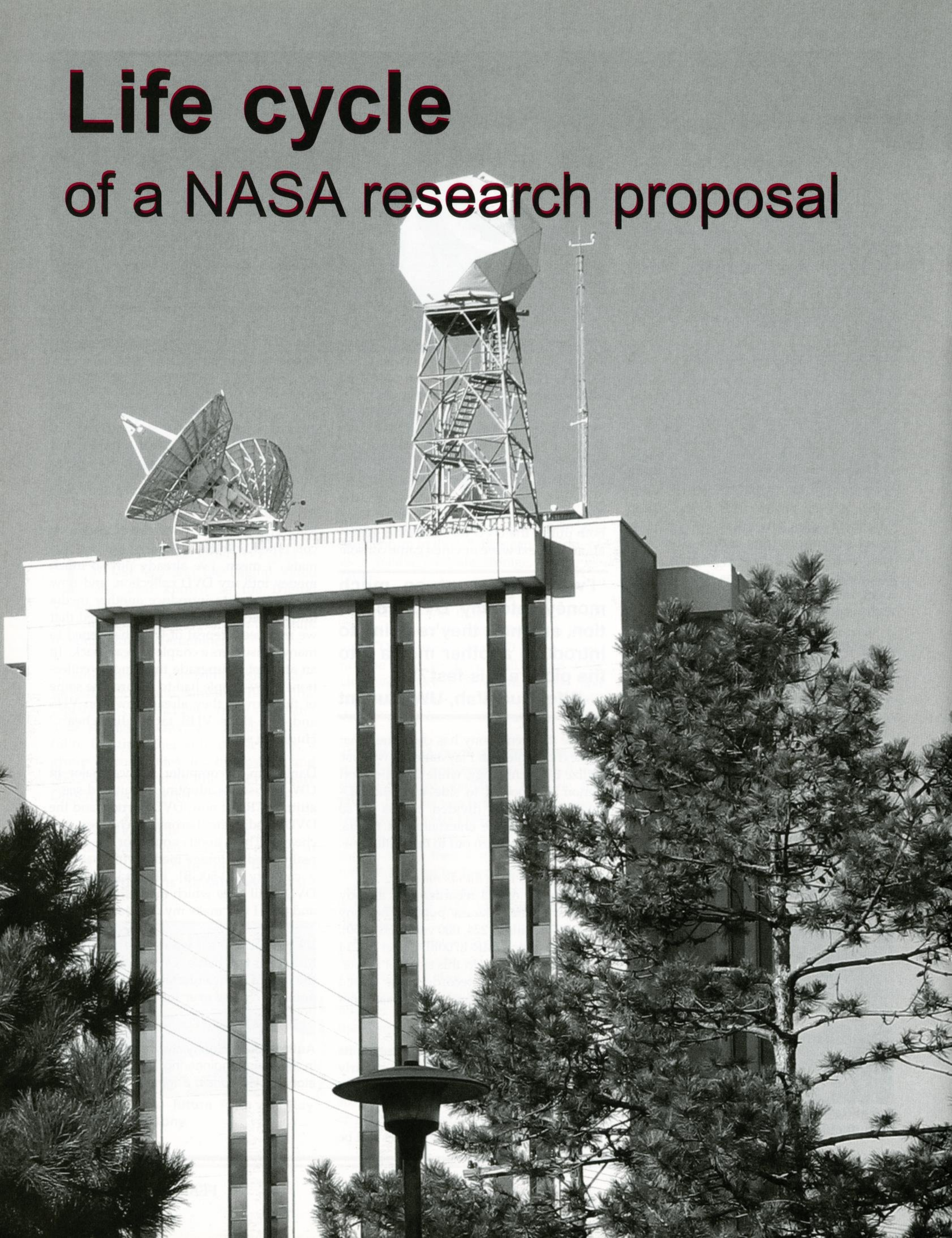
Danil Lim, a computer science major in UW-Madison is adopting a wait-and-see attitude. "Right now, DVD burners and the DVD media are becoming cheaper and cheaper. That's good enough for me. I don't really need a storage media with that high a capacity [20-50GB]. I'll stick with the DVD until I see which media has an edge and then I will make my decision," he says.

It's too early to tell which side will be victorious in this battle. One thing's for sure, the face of home entertainment is certainly going to change over the next few years. WE

Author Bio: Sonny Suciawan is a senior in industrial engineering. This is his fourth story for *Wisconsin Engineer*.

Life cycle

of a NASA research proposal



By LaShunda Prescott-Manly

On Feb. 3, 2003, the National Aeronautics and Space Administration (NASA) announced that it was accepting Small Explorer (SMEX) satellite proposals for its SMEX program - a part of NASA's Explorers program that provides flight opportunities for relatively inexpensive science missions. Three months later, the 36 proposals submitted to NASA included UW-Madison's Space Science and Engineering Center's (SSEC) proposal for the Missing Baryon Explorer (MBE) SMEX satellite.

SSEC

Located in the Atmospheric, Oceanic and Space Sciences Building--which Terri Gregory, the Public Information Coordinator at SSEC, describes as "the tall skinny building with all the equipment on the roof"--the SSEC is the home to projects and programs that focus on atmospheric and earth sciences, planetary and space sciences, and instrument development. Much of the funding for the projects comes from the federal government: NASA, the National Oceanic and Atmospheric Administration, the National Science Foundation (NSF) and the U.S. Department of Energy.

A quick visit to the SSEC's website reveals scientists and engineers are working on projects of major scientific significance. Scientists are collecting data from the Antarctic Meteorological Research Center, the Voyager spacecraft and the Neptune Atmospheric Research project, the Hubble Space Telescope and ground-based observations and the Ice Coring and Drilling Services (ICDS.) The ICDS project provides support for NSF-sponsored cold regions research in both Polar Regions and at high altitudes. The project maintains and operates ICDS's equipment and develops new systems to provide high quality ice core and boreholes used for research.

The MBE SMEX Satellite Proposal

Using the Spectrum Astro SA-200s Bus as its spacecraft, the proposed MBE weighed 326 kg and cost $118.96 million dollars. The MBE will use Pegasus XL as its launch vehicle in August 2007 from the Kwajalein Missile Range Launch. Post blast-off, the mission will be monitored from UW-Madison's space and mission operation centers.

The MBE proposal included an education and outreach component. This element, a fundamental piece of any NASA mission, will be led by Rosalyn Pertzborn, director of the Office of Space Science Education and Dr. Sanjay Limaye, an expert in Planetary Atmospheres at SSEC.

36 proposals submitted to NASA included UW-Madison's Space Science and Engineering Center's proposal for the Missing Baryon Explorer (MBE) SMEX satellite.

The proposed MBE mission has two objectives. The first is to find the current locations and properties of the baryons - a group of elementary particles (such as nucleons) that are subject to the strong force and are held to be a combination of three quarks created in the early universe. The missing baryon explorer project looks for normal (baryonic) dark matter astronomers know should exist, but haven't yet seen. The second objective is to understand the role of hot material in the life cycles of galaxies and stars.

To achieve its goals, the MBE's science payload included an X-ray Calorimeter Telescope. UW-Madison, NASA's Goddard facility and Lockheed Martin will develop it. For the principal investigator of the MBE project, Dr. Wilt Sanders, this was familiar territory. He had already been a principle investigator for the team that developed the Diffuse X-ray Spectrometer STS-54, which went up as part of the Endeavour Space Shuttle Mission in 1993. Despite this experience, Sanders worked with other members of the instrument team to better define the X-ray telescope described in the proposal.

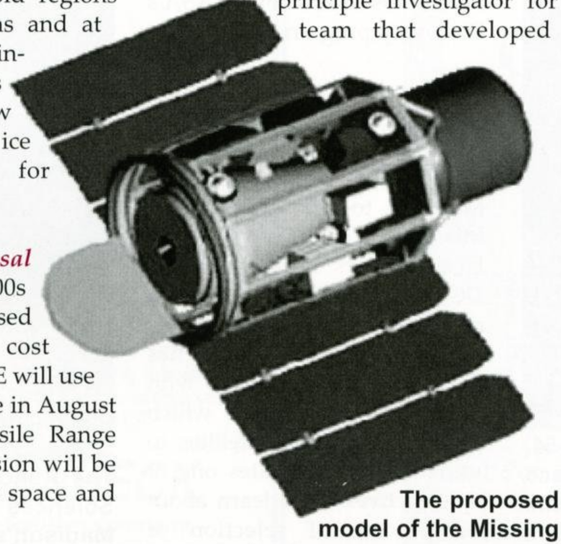


Photo by UW-Madison's Space Science and Engineering Center

The proposed model of the Missing Baryon Small Explorer satellite.

"We had to tie the current understanding and theories of the formation of large scale structure in the universe - what is the signature of the missing baryons and what those theories predicted about the X-ray emission from those missing baryons - all

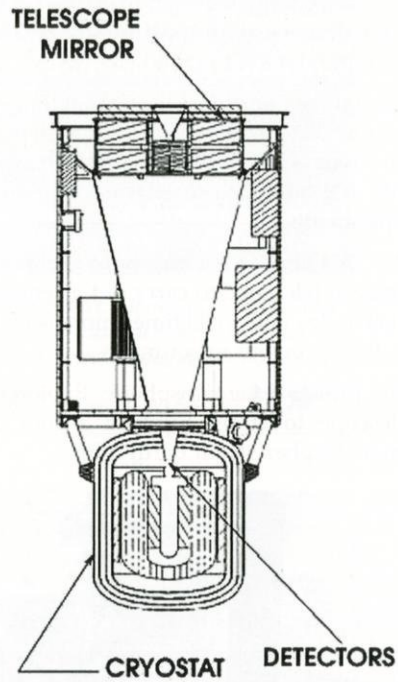


Photo by UW-Madison's Space Science and Engineering Center

The proposed design of the X-ray Calorimeter Telescope that was to be developed by UW-Madison, NASA Goddard and Lockheed Martin.

together to make sure that the instrument that we proposed to build and fly had the ability to measure the X-ray emission that was predicted by theory," he says.

"[This would ensure] that our detection, or lack of detection, would be a valid test of theory," Sanders adds. "That is, we had to make sure that if the missing baryons existed as predicted, our instrument would be able to detect them."

NASA Selects 5 SMEX Proposals

NASA selected five more proposals for further consideration in November 2003. Unfortunately, despite the efforts of Sanders and the rest of his team, the MBE was not among them.

intend to propose it again when NASA next issues a call for proposals for SMEX projects," Sanders says.

The SMEX proposals that NASA accepted to study for flight in 2007 or 2008 are:

The Normal-incidence Extreme Ultraviolet Spectrometer: a solar spectrometer with major advances in sensitivity and resolution to reveal the cause of coronal heating and solar wind acceleration.

The Dark Universe Observatory: seven X-ray telescopes to measure the dark matter and dark energy that dominate the content of the universe with 100 times the sensitivity of previous X-ray studies.

The Interstellar Boundary Explorer: a pair of cameras to image the boundary between the solar system and interstellar space with 100 times the sensitivity of previous experiments.

The Nuclear Spectroscopic Telescope Array: a telescope to carry out a census of black holes with 1000 times more sensitivity than previous experiments.

The Jupiter Magnetospheric Explorer: a telescope to study Jupiter's aurora and magnetosphere from Earth orbit.

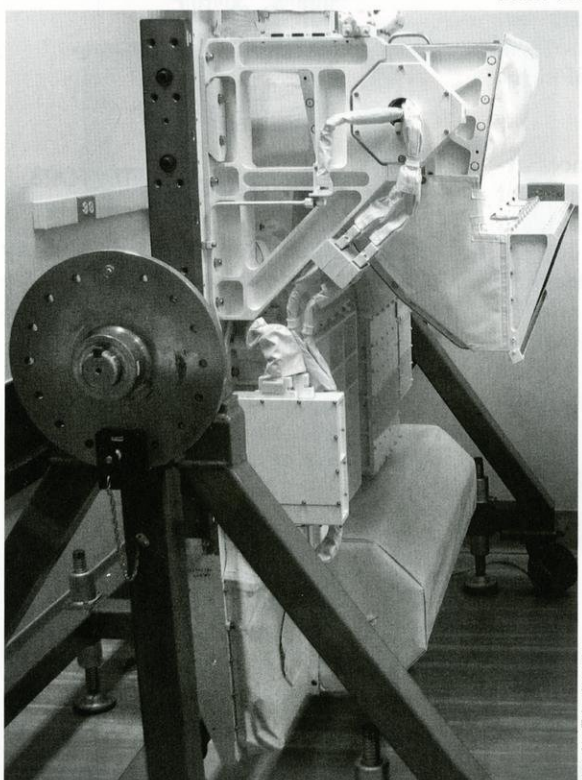


Photo by Erin Jacobs

Part of the Diffuse X-ray Spectrometer STS-54, that went into space with the Endeavour Space Shuttle Mission in 1993, sits in a clean room in the Atmospheric, Oceanic and Space Sciences Building.

The MBE team at SSEC "Moves On"

Unlike a situation where a project dissipates, the doors at SSEC did not shut and no "pink slips" were issued.

Gregory says it is possible to continue working when a proposal or two are not funded.

"NASA prefers to have a smaller, more focused, primary team," -Dr. Wilt Sanders

"Folks are not hired until funding is received, so, unlike a corporation, there is no need to lay off people if a proposal is not accepted," Gregory says. "There is already someone on staff who can handle a project [when the project is proposed]."

Despite their hard work on the MBE, the SSEC team members associated with the MBE project are moving on to the next project. Some have found new projects to work on at SSEC. Rosalyn Pertzborn has been on both sides of the process. She was a proposal reviewer as part of NASA Headquarters' Scientific Review Panel and a member of many teams' submitting proposals. She also continues to lead education and outreach efforts for other space science projects.

Meanwhile, Limaye is currently working on a proposal that hopes to send a mission to Venus as part of NASA's Discovery program.

Like Sanders, others have started doing projects outside of SSEC. Sanders has taken a two-year leave of absence from UW-Madison to join the Science Mission Directorate at NASA Headquarters in Washington, DC. He is a part of a team reviewing the NASA sounding rocket program. There, he has the opportunity to work with the people who decide which proposed Explorer satellites to funded. Sanders states one of his objectives is "to learn about the process of selection of Explorer payloads so that when I return to UW, we can write a better SMEX proposal than we have in the past--one that will be selected next time."

In Retrospect

When Sanders looks back at why the MBE proposal was not accepted, he finds a few possible reasons.

"I probably spent too many pages describing all the neat science [the MBE] could address and showing the results of simulations, without providing a detailed enough description of the assumptions and methods of those simulations for the scientific review panel to convince themselves that our claims were substantiated. Maybe we were too optimistic about the willingness of the technical review panel to accept our assessment that the risk of failure of this instrument was low - they rated it as 'medium' and that was very not good," he says.

Sanders also says he speculates the team of investigators may have been too large. "NASA prefers to have a smaller, more focused, primary team," he says. "So when we propose this mission to NASA again in the near future, we will have a smaller team."

It seems just a matter of time before the Missing Baryon Explorer SMEX satellite finds its home in space. WE

Author Bio: A recovering electrical engineer, LaShunda enjoys hanging out with her husband and three children.

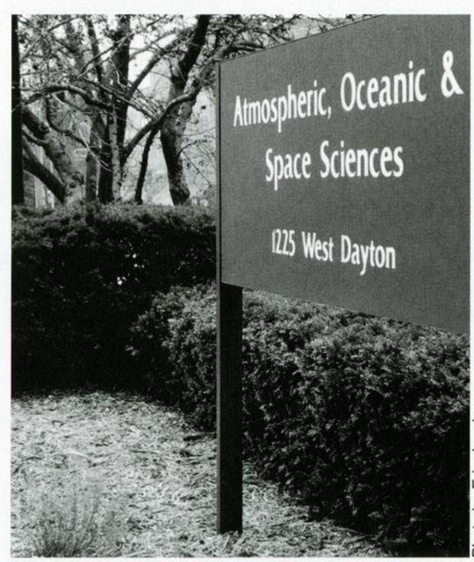


Photo by Erin Jacobs

The Atmospheric, Oceanic and Space Sciences Building houses UW Madison's Space Science and Engineering Center.

EXPOSED to Engineering

By Nick O'Brien

A tremendous event is coming to the UW-Madison Engineering School grounds. This event is the Engineering Expo 2005, and it is rapidly approaching. It will devour the space in lobbies, hallways and classrooms. It will engulf everything and everybody in its way - children, students, old men and women.

The Engineering Expo, one of the nation's large student-run events, invokes the passion for engineering in those uncertain of the profession's effect on their life. For three days in mid-April, the engineering school's campus will be flooded with businesses, undergraduates and graduate students showing off what they think is exciting about engineering. The Expo will be filled with innovations that have come to life from the UW campus and elsewhere. Organizers encourage presenters to make their displays understandable to the layman.

Justin Kutney, UW-Madison senior in the mechanical engineering department and the Engineering Expo's head of student exhibits, explained the event's purpose.

"The expo is here to get people interested in engineering: for the high school senior maybe it helps him to recognize the possibilities in engineering, and for the twelve-year-old kid it's cool to see a piece of acrylic explode," he says. "I got emailed from people interested in the Expo during the summer, I wasn't even ready to accept them into Expo, I just wrote back that I liked their energy."

The Engineering Expo, a biannual event, averages about 10,000 to 15,000 visitors who pace past 70 to 75 displays. One third of the displays are for various student-run organizations. The student organizations that participate in the Engineering Expo use them as optimal opportunities to recruit students and explain to them what their organization precisely does.

Companies like Ford, Kimberly Clark and Sub Zero use the Engineering Expo in a similar way. In addition, the businesses use the facility for free and their representatives receive complementary room and board.

"Not only do the businesses get some free advertisement, but some students walk around dressed up, with resumes in hand, and use the expo as a kind of career fair," Kutney says.

There are also many opportunities for high school and middle school students to compete for prizes. They have a wind race, a competition in which the students are asked to build a device to help people play with mini golf. The Engineering Expo chairs are proposing a "build your own mini hot air balloon contest" as well. These contests are open kids from kindergarten to the high school grades.

"It's a way to introduce students to the kind of problems that are out there and to spark some sort of interest in engineering," competitions head for the Engineering Expo Dusty Brunner says.

Roughly $8,000 worth of prize money and gifts are awarded to the top three displays. Another award goes to the people's choice display.

The prizes are awarded based on the recommendations of UW-Madison faculty judges. The judges focus primarily on who best explained engineering concepts to non-engineering people.

"If you can take something complicated, but make it understandable and interesting to the passerby, then you have a good shot at winning," Kutney says. WE

Author Bio: Nick O'Brien, a double major in acting and chemical engineering, enjoys his second semester writing for the *Wisconsin Engineer*.

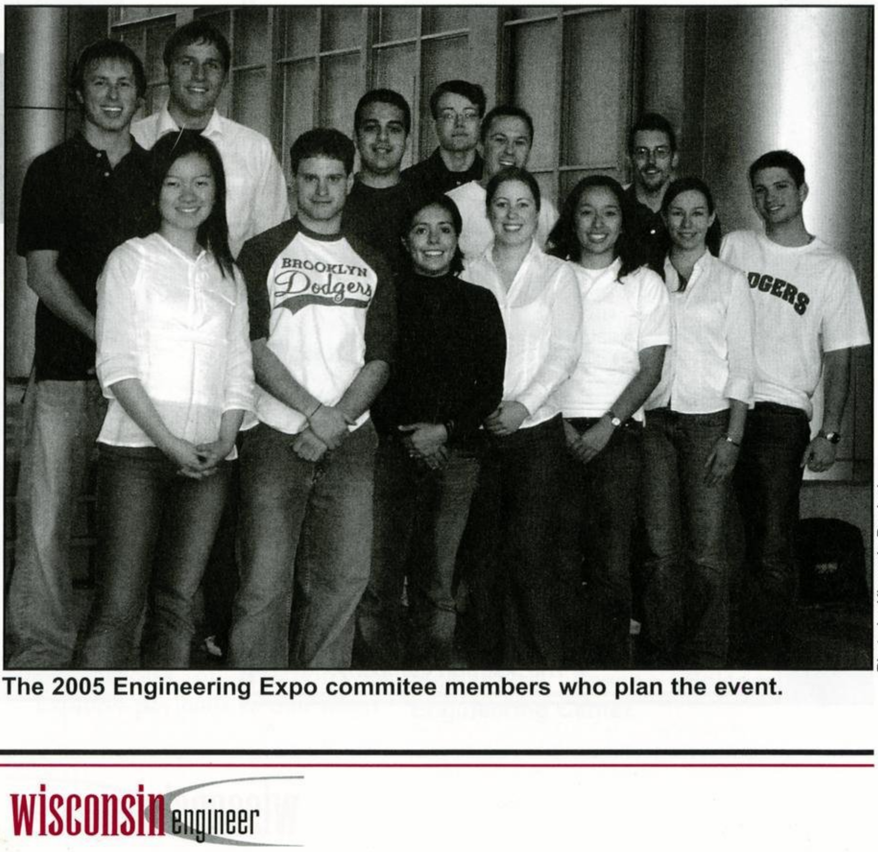


Photo by Khawaja Daniyal

The 2005 Engineering Expo commitee members who plan the event.

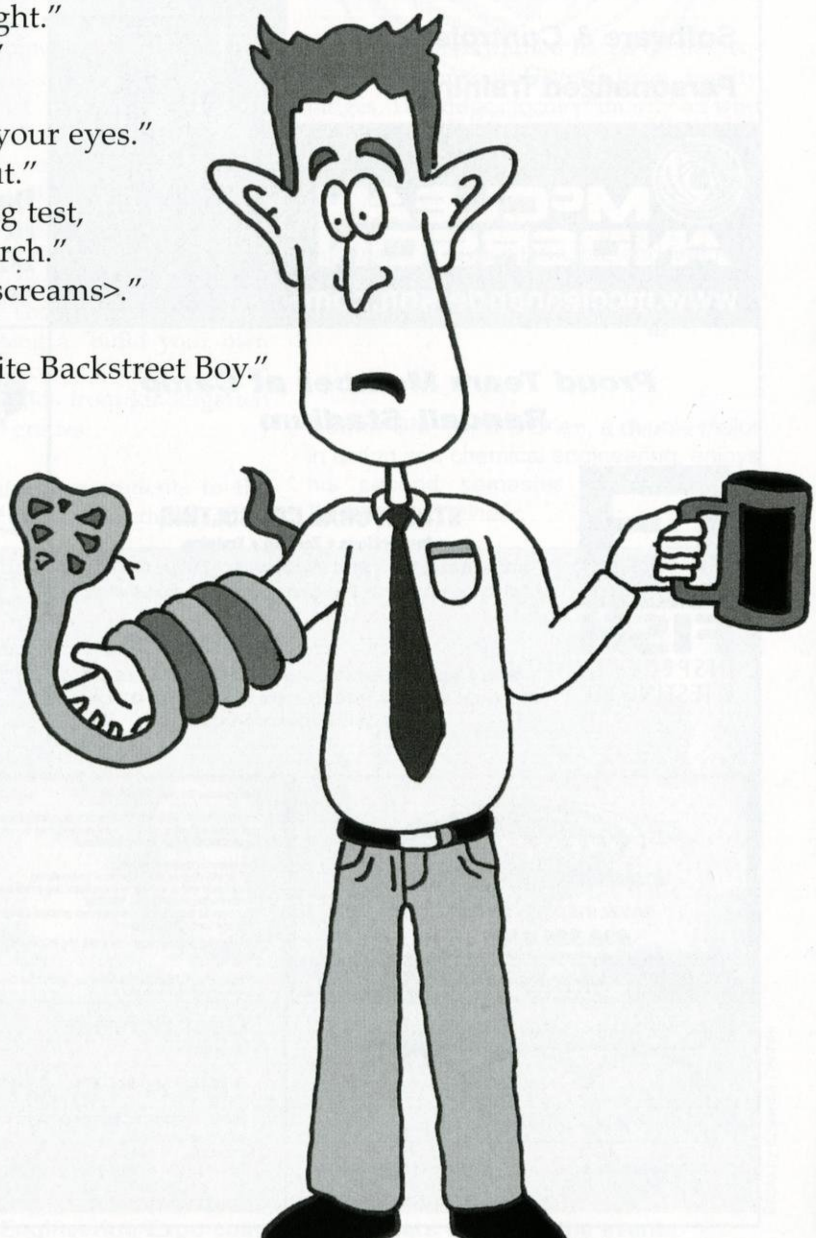
Just One More

The Finest in Eclectic Humor

By Skye McAllister

Top 15 Things Your Boss Says Proving Your Internship is Going to Suck

15. “If you know how to work a coffee maker and make copies you're hired.”
14. ”This is where they got the idea for that one episode of Fear Factor.”
13. “After every week we will be eliminating one intern in the board room.”
12. “There's only one outhouse, so try and go to the bathroom before work.”
11. “You will get used to the smell of burning flesh after a month or two.”
10. “Here are the keys so you can lock up tonight.”
09. “Whatever you do, do not take his stapler.”
08. “To start your computer turn this crank.”
07. “If you are afraid of cobras or tigers, close your eyes.”
06. “See that guy with one arm, yeah, paper cut.”
05. “Before accepting you must first take a drug test, followed by a de-lousing and a cavity search.”
04. “Do not, I repeat, do not go in that room <screams>.”
03. “If you have any questions, just ask HAL.”
02. “Don’t forget, Friday is dress as your favorite Backstreet Boy.”
01. “Pay check? I don’t think so.”



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