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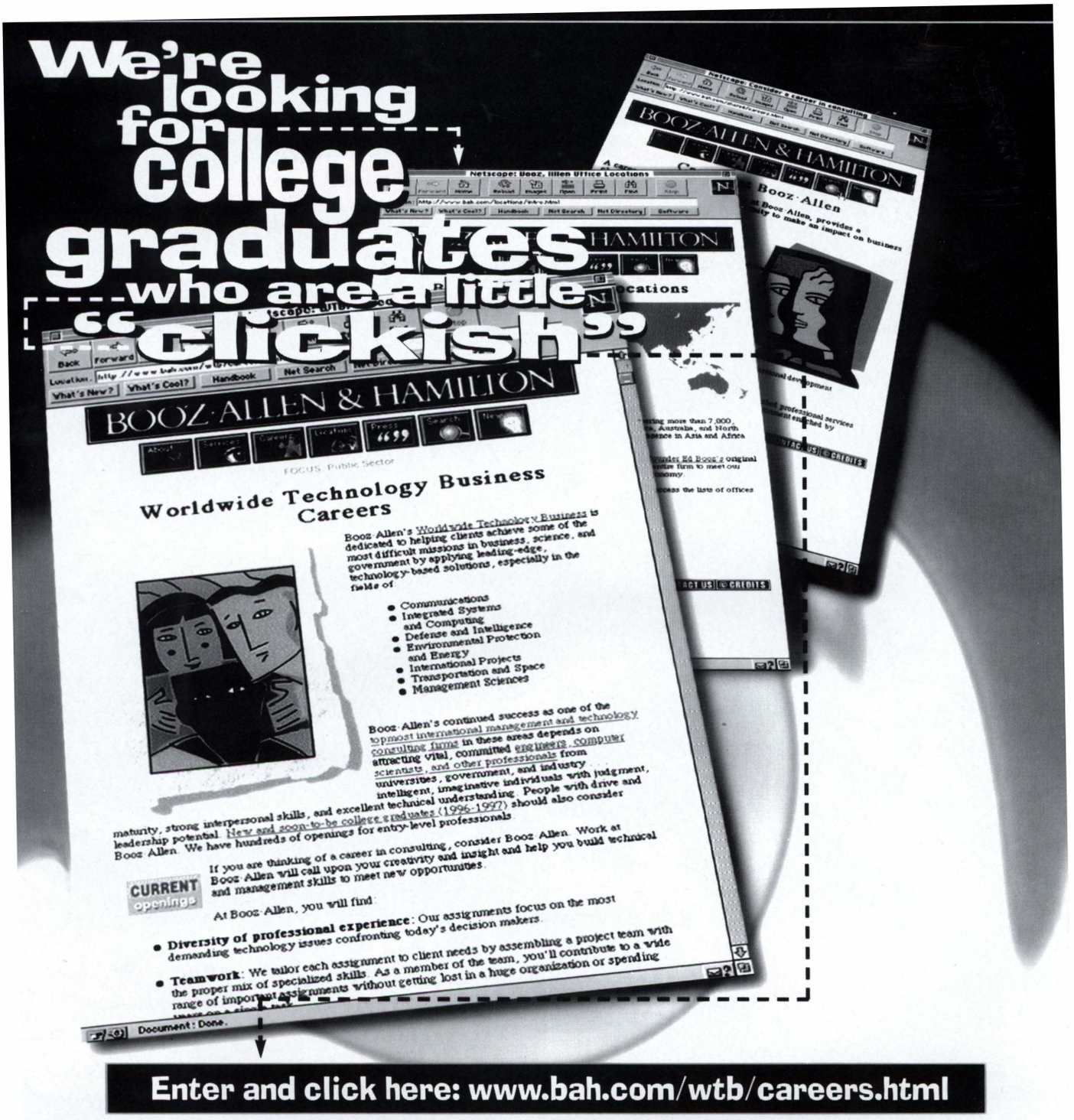


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The Engineering Magazine at Virginia Tech

ENGINEERS' FORUM

VOLUME 16, NUMBER 3

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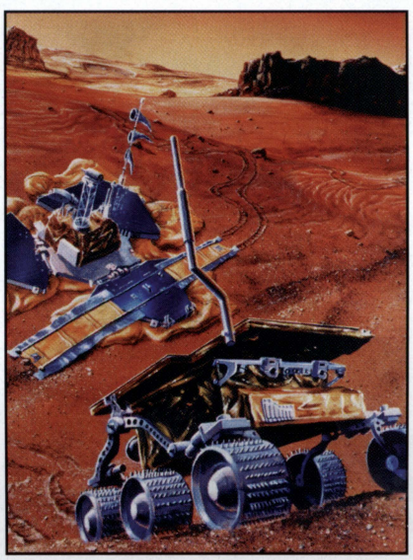
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On the Cover

An artist rendering shows the Mars Pathfinder lander and rover in operation on the Martian surface in July 1997. Once on the surface, the lander petals will deploy to expose three solar panels for power.

Drawing courtesy of NASA

EXPO:

JobFair of Dreams

The 18th Annual Engineering Expo will be hosted by the Student Engineers' Council in Squires Student Center on September 16 and 17. More than 150 firms and government agencies will be on hand to recruit potential employees from the engineering student body at Virginia Tech. The event offers students and company representatives a chance to meet in an informal setting and many times leads to job interviews and employment.



Expo is a great opportunity for students to meet engineering professionals.

The SEC, a self-funded student organization, expects more than 5,000 students will be in attendance to exchange information with company representatives. For many students, Expo is an ideal time to get to know prospective employers and drop resumes. For those not yet shopping for a job, it is a chance to realize what it takes to be marketable in today's corporate environment.

This years overwhelming response provides students with tremendous employment opportunities

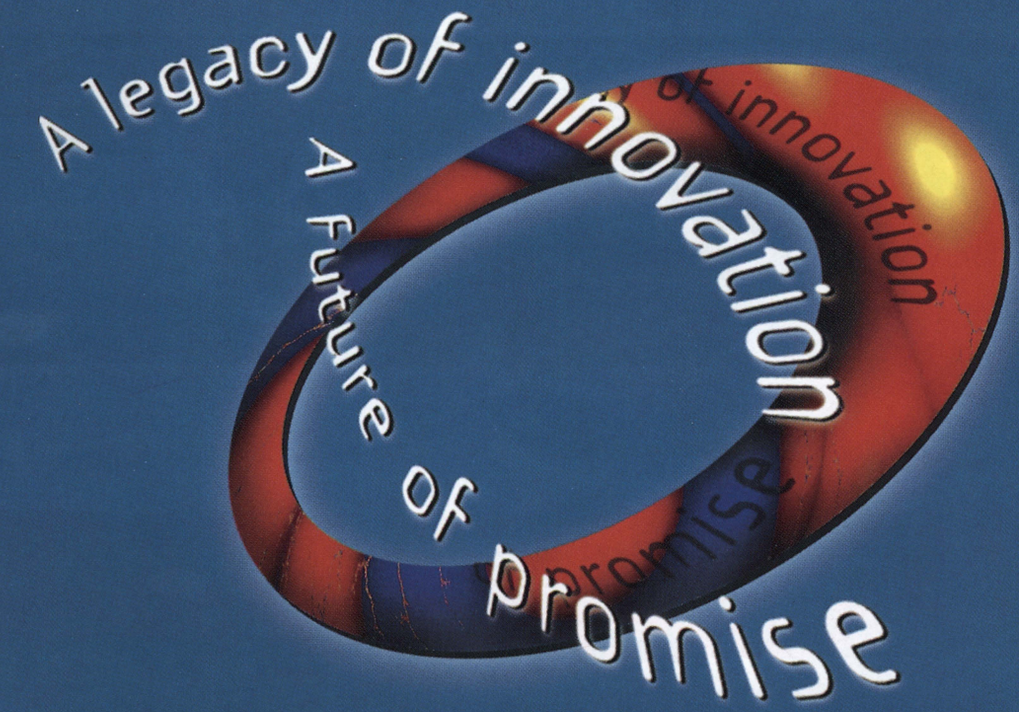
The chairperson of the Expo committee, Monique Jackson a graduate student in chemical engineering, was chosen through an application process

Preparations for Expo begin as early as February. Due to the numerous responsibilities, a large committee is required. The Expo '97 Committee consisted of more than 20 students.

The SEC also provides a resume book service, available to all disciplines in the College of Engineering. For a fee of $0 per page, student resumes are printed in the book which is then distributed to each company in attendance. This service allows the companies to view hundreds of student resumes, compiled by major. Companies are then able to leave messages at the registration table for students with whom they would like to speak. Students attending the Expo then check the table to see which companies are interested in them.

The exposition opens to the engineering student body on Tuesday, September 16, from noon to 5 p.m. Expo continues on Wednesday, September 17, from 9 a.m. to 4 p.m. Students are invited to walk through the exhibits, many of which include videos, products, promotional items, demonstrations and other items which detail what the companies do. This corporate showcase is an extension of the SEC's mission: To promote the personal and professional development of student engineers at Tech by helping them to define career goals, pursue career opportunities, and develop leadership skills. EF

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Roving the Red Planet...

By Ray Easterling

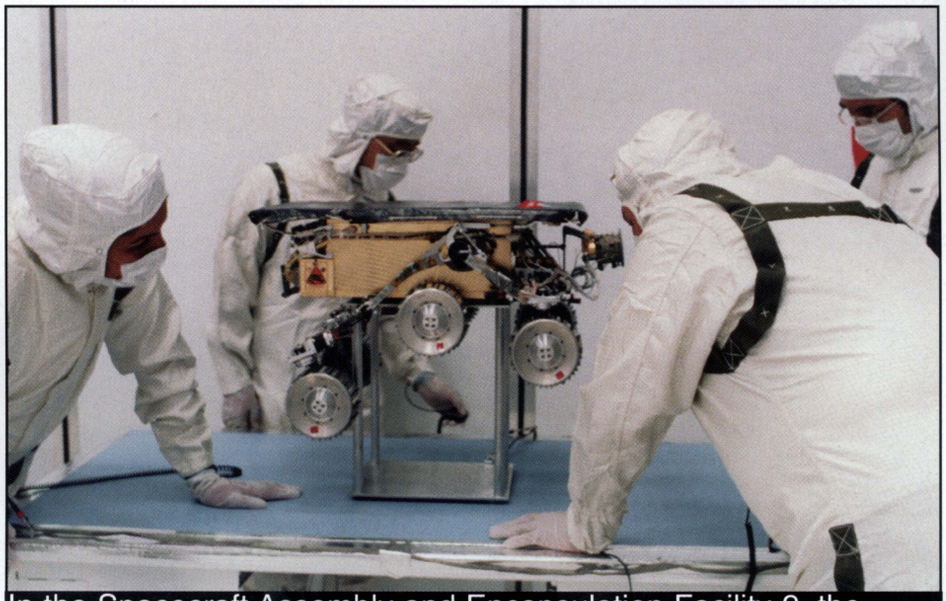
In a summer filled with high tech, alien blockbusters, the biggest winner by far was NASA's robotic mission to Mars.

The first mission in 20 years has been declared a "100 percent success" by NASA scientists as Pathfinder wrapped up it's initial 30-day mission. Since landing on the Martian surface on July 4, Pathfinder has taken roughly 10,000 images and returned twice as much data as scientists expected. The amount of data collected was due in large part to the six-wheeled rover named Sojourner. The use of the rover results from new strategies by NASA to operate more efficiently and cheaply.

Project scientist Matthew Golombek called Sojourner "the most excellent rover imaginable. [This] gives us tremendous confidence" about the feasibility of using small rovers to cheaply explore Mars further.

"[It's success] proves that future rovers don't have to be pickup trucks to do good science," said Donna Shirley, program manager for the Mars expedition.

After covering more than 50



In the Spacecraft Assembly and Encapsulation Facility-2, the small rover for the Mars Pathfinder mission has been unpacked from its shipping container and is undergoing inspections.

yards of territory and taking millions of weather readings, the emphasis of the mission will shift. The main goal now "is to stay alive as long as possible," Golombek said.

Scientists are hopeful the moving parts and batteries aboard the lander and rover will keep working for months, perhaps years. The scientists would like to study the climate changes as Mars, currently in late summer, moves through autumn, winter and spring.

Sojourner has the assignment of studying an area called the Rock Garden for most of August. Afterward, the tiny rover will climb a hill 60 feet high. The trek, while only 100 yards to the top of the hill, will be an arduous task for the microwave-oven-sized robot. Sojouner has a speed of less than one half-inch per second. The rover also stops every quarter turn of the wheels to ensure it is still in contact with the Sagan lander. Scientists estimate the trip itself could take a month.

"But once we get to the top, we'll be able to see a whole new vista of Mars we have never seen before, and from an angle looking down, not up," Golombek said.

Now that the emphasis of the mission has shifted to the long-term monitoring of conditions, Martian weather has become a primary interest. Scientists have already recorded instances of four dust-devils on the Red Planet's surface. The menacing dust-devils resemble small tornadoes.

Scientists also hope to gather information on the Martian dust storms, which occur in November and December. The Martian soil, which has the consistency of fine powder, is sent miles into the atmosphere during the global storms.

"I think we finally have a feeling of what it could be like to stand [on Mars]," Golombek said. "We know what our footprints would look like."

The Pathfinder mission has also left its mark back home on Earth as well. The mission's various internet sites have registered more than 566 million hits to date, making it "the largest Internet event in the history of the world," Golombek said.



The decent to Mars.

"...Once we get to the top, we'll be able to see a whole new vista of Mars we have never seen before..."

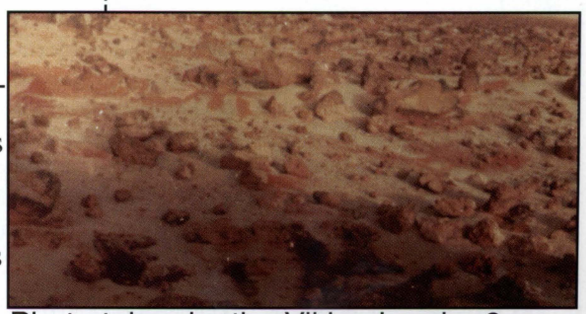
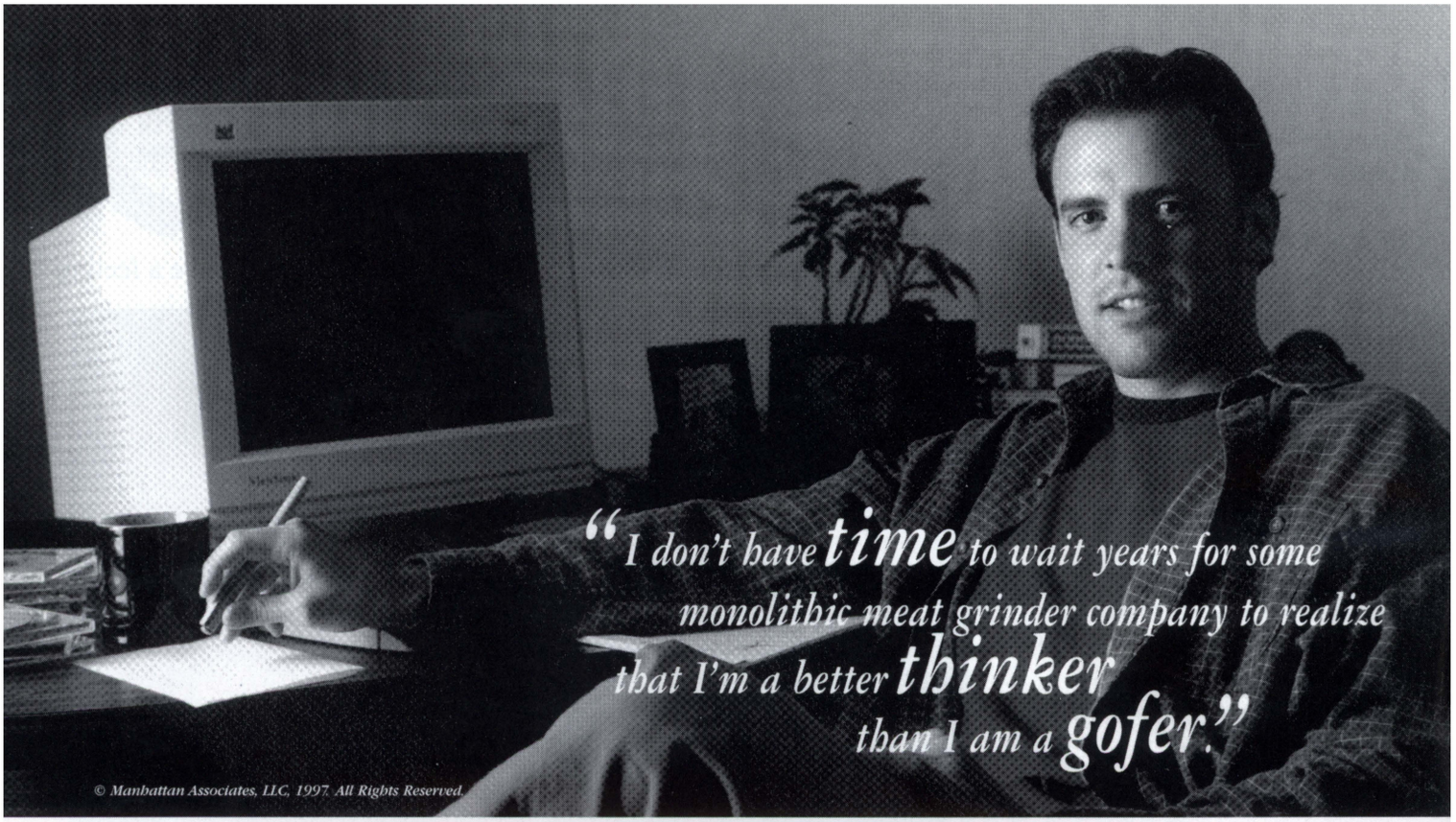


Photo taken by the Viking Lander 2 on May 18, 1979.



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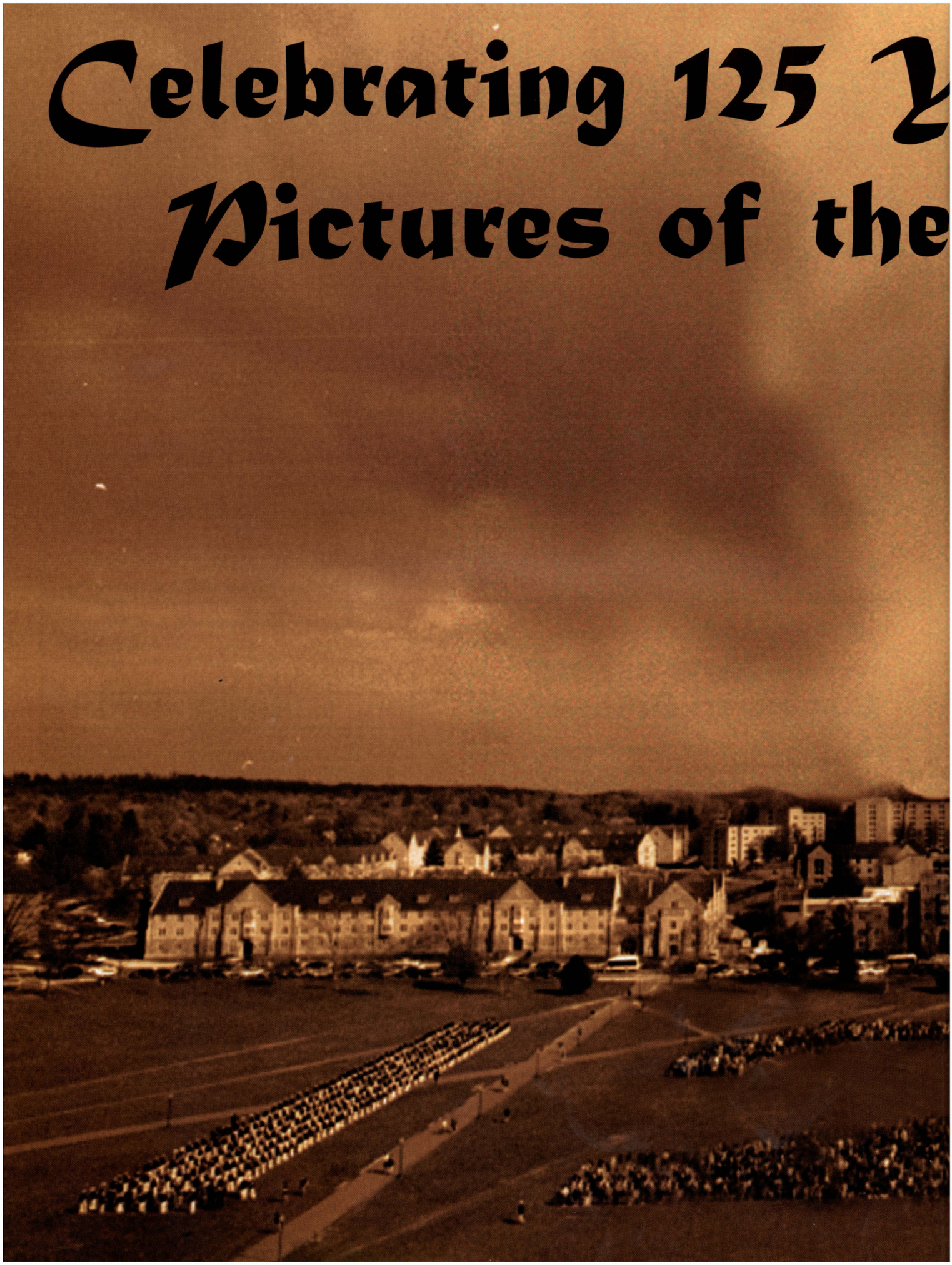
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Celebrating 125 Y
Pictures of the



ears...

Past and Present

Text by Steffanie Liskey
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and Mitch Hazam
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Photo left: Campus, 1900. Seen in photo from left to right: Faculty Row, YMCA building (under construction), the Barracks and Academic Buildings.

have not been erased though, and they are evident throughout the campus known as home to over 100,000 students and alumni.

Virginia Agricultural and Mechanical College began with one building, the Preston and Olin Building. Since then the college has evolved into approximately 100 buildings that echo with history. And now, after 125 years, what stands before us is Virginia Tech. Its deep roots





The pictures from the past are filled with pride, joy, hard work, and beauty. From the serene calm of the Duckpond to the

Photo above: The Duckpond after a winter snowfall.

Photo left: The Preston and Olin Building, a remnant of Preston and Olin Institute when V.A.M.C. opened in 1872.





excitement of registering for classes, time has not changed the spirit of this university. It is what defines us. It is what makes us Hokies.

The pictures on these pages are whispers of the past and the present. Whether we hear there message each day as we cross the Drillfield or not, they speak to us now as we reflect on the long journey that has brought us to this point. 125 years of excellence... let the celebrating begin.



Photo above, left: Burruss Hall has become an icon for Tech and is well recognized by many.

Photo above, right: Dr. Julian Ashby Burress, the eighth president of the university from 1919 until 1947.

Photo left: War Memorial Gym as seen today.

Continued on page 14.

Matter's Evil Twin

By Shuvom Ghose

Even after most people accept the existence of this honored citizen of science fiction, they place a mental asterisk by it, marking antimatter as some magical thing outside their normal experience, totally unlike "normal" matter. This is untrue.

Antimatter has much the same properties as the matter making up the pages of this magazine, the dirt under your fingernails, or the Earth itself. It has mass and takes up space. It feels the pull of gravity, and can be seen when light falls upon it. So what makes antimatter different from the matter all around us?

Antimatter is the mirror image of matter. To understand the analogy, consider the proton. A proton has a mass of about $1.6*10^{-27}$ kg, an electric charge of +1, and can spin on its axis like a planet. We can imagine ours spinning from our left to right.

If you were looking into a mirror, your reflection would be the same size as you. Thus, the mirror image of a proton would be treated the same and would still have a mass of around $1.6*10^{-27}$ kg. If you raised your right hand, your mirror image would raise its left, opposite hand. So the electrical charge of this antiproton would be the opposite of a proton's, namely -1. And just as left and right are reversed in your mirror image, the mirror image of our proton would spin from right to left on its axis.

The analogy holds true for the other subatomic particles besides the proton, such as the electron and neutron. An antielectron, also called a positron, has the same mass as a normal electron, an opposite charge of +1, and an opposite spin. An antineutron has the same mass as a neutron and an opposite spin. However, because the charge on a neutron is zero, the charge on an antineutron is also zero. For all these similarities, there is one sharp difference in the way matter reacts with itself and the way it reacts with antimatter. When two normal protons are brought close together, their similar electrical charges repel, and the protons dance and bob and weave to avoid each other, like two professional boxers sparring in a ring. However, when a proton and antiproton are introduced in close quarters, their opposite charges attract. The particles rush toward each other, hell-bent on having a violent collision, like two professional wrestler's sparring in a ring. When they collide, the proton and antiproton annihilate each other.

It is real. No matter how many images of the fictional Starship Enterprise it conjures up or how mythical the word itself sounds, antimatter is real.

The impact of this collision converts the mass of the two subatomic particles completely into energy, leaving no trace of the original bodies. The amount of energy released in the annihilation is given by Einstein's famous equation, $E=mc^2$, where *m* is the combined mass of the particles, and *c* is the speed of light. Since the speed of light is very large, it is easy to see that a very small amount of antimatter could be used to generate a spectacular amount of energy. So why not grab a handful of antimatter and use it to power New York City for the next hundred years?

The simple answer is that not only antiprotons cancel out their mirror images. Any particle will annihilate its antiparticle, and by extrapolation, atoms of normal matter will destroy atoms of antimatter. Thus, had there once been any antimatter laying around here, it would have all been canceled out long ago by the preponderance of normal matter in which we are swimming.

So how did we know antimatter existed in the first place, if there isn't any around to discover? In 1929, a physicist named Paul Dirac set out to combine the equations dealing with quantum mechanics, special relativity, electromagnetism and the behavior of the electron into one group. When he succeeded, he found that there were two solutions that satisfied his new set of equations. One answer dealt with electrons that had a positive amount of energy, the electrons in our normal lives. The other solution described electrons with a negative amount of energy, something alien to physics at the time. Alien, that is, until Dirac discovered that the negative energy electron passing through a magnetic field would act just like a normal electron with an opposite charge. Thus the positron was predicted to exist.

The first sighting of a positron came in 1932 at California Polytechnic Institute. Robert Millikan and Carl Anderson were using a cloud chamber to detect charged particles resulting from Earth's constant bombardment with cosmic rays. As each charged particle passed through their cloud chamber, it left a trail in the supersaturated vapor inside. A magnetic field set up around the cloud chamber caused

the particles to change course, and the direction and amount of the bend revealed the charge and mass of the temporary intruders. After a while, Anderson noticed that something was making trails similar to the ones made by electrons, but in an opposite direction. That something had to be a particle with the mass of an electron but an opposite charge. A positron.

Discovering the antiproton proved to be much more difficult, since cosmic rays had enough energy to create positrons, but not the much more massive antiprotons. (If it's puzzling how energy can create matter, remember that $E=mc^2$ goes both ways. A sufficiently concentrated amount of energy can create a pair of oppositely charged particles.) The energy needed to make antiprotons could only come from an artificial source, and that source found form in the Berkeley Bevatron particle accelerator at the University of California. A particle accelerator can be used to create antiprotons by pushing normal protons up to a very high speed which highly increases their kinetic energy, and then slamming them against protons at rest. The immense energy of collision is transformed into part normal matter and part antimatter.

On October 4, 1955, after 18 months of set up and fifteen minutes of actually shooting protons, the team of Emilo Sergè, Clyde Weigand, Thomas Ypsilantis and Owen Chamberlain detected their first antiproton. Within eleven months, another group of researchers working at the Berkeley Bevatron had detected the last member of the trinity, the antineutron. The modern era of antimatter production could finally begin.

Between then and now, antimatter has grown to become a big deal. Particle accelerators much more powerful and capable of producing antimatter than the Bevatron have been built at research facilities around the world. Fermilab in Chicago, Illinois, **CERN** near Geneva, Switzerland, and **IHEP** in the former Soviet Union are several top examples. Needless to say, as the number of sites capable of doing antimatter research has increased, so have the number of experiments tried and completed successfully. So far, scientists have, for the sake of curiosity, created an antideuterium nucleus, an antitritium nucleus, and an antihelium-3 nucleus. Deuterium is a molecule of hydrogen that has one extra neutron in the nucleus and likewise, tritium is a hydrogen molecule with two extra neutrons. Helium-3 is a molecule of helium that contains two protons and one neutron in the nucleus. Each of these molecules are isotopes of their base elements, hydrogen and helium. The antimolecules are comprised of antiprotons and antineutrons in the same way as the molecules are comprised of protons and neutrons. Thus, an antideuterium nucleus is comprised of an antiproton and an antineutron.

By far the biggest advances have been in antimatter storage. In the beginning, scientists let the antimatter they created just hit the end of the accelerator and vanished out of existence. After all, how do you attempt to contain something that vanishes whenever it touches the sides of its container or comes in contact with the air?

The solution now used around the world is to magnetically levitate the charged antiprotons and positrons in a vacuum chamber at temperatures close to absolute zero. Such magnetic storage devices are called Penning traps, and have recorded performances of holding, on separate occasions, more than 10^6 antiprotons and 10^8 positrons. While this may sound impressive, remember that a thimbleful of air contains about $2.6*10^{22}$ molecules, which is as much as 10^{14} times larger.

Right now, the biggest push in the field is to create the simplest atom of antimatter, antihydrogen. This has been done at CERN, but the technique used only created antihydrogen traveling at a very fast speed, and it existed only 37 nanoseconds before it hit some of the experimental setup. The stumbling block is not convincing the positron to orbit the antiproton, since that would be their natural tendency, but to create an antiatom which is standing still and can be contained for further study. But what would be the benefits of straining and pushing and sweating to create lasting antihydrogen?

"Right now we want to produce thousands of antihydrogen atoms only to make a detailed check on the symmetry between matter and antimatter," said Michael Charlton, a scientist at University College London. "This might include gravity checks," he continued, referring to tests to see if gravity affects normal matter and antimatter in exactly the same way, just as tests have been done to see that the mass of a proton and antiproton agree to the 10^9 decimal place.

Since making antihydrogen is good, one might assume that making other, more complicated antielements would be even better. Charlton sets us straight by saying, "Even producing antihelium nuclei at accelerators in expensive and inefficient. I don't see a future in building up the antiperiodic table," and that, "There is no mass production facility for atomic antimatter in existence or planned. I want to really stress this. We are not going to be able to amass large quantities of this stuff."

So if we won't be producing ten antiatoms of it or ten tons of it, what do the next 25 years hold in store for antimatter? Not much it seems beyond research. Charlton comments, "You should get antihydrogen at low energies. Then it'll be trapped, then it'll be studied spectroscopically, and then.....I'll retire." And that's when the torch will be passed to us, the next generation of scientists and engineers, to continue the research. Research not only to better understand the mirror of matter, but the reflection itself and how it affects the universe we inhabit.

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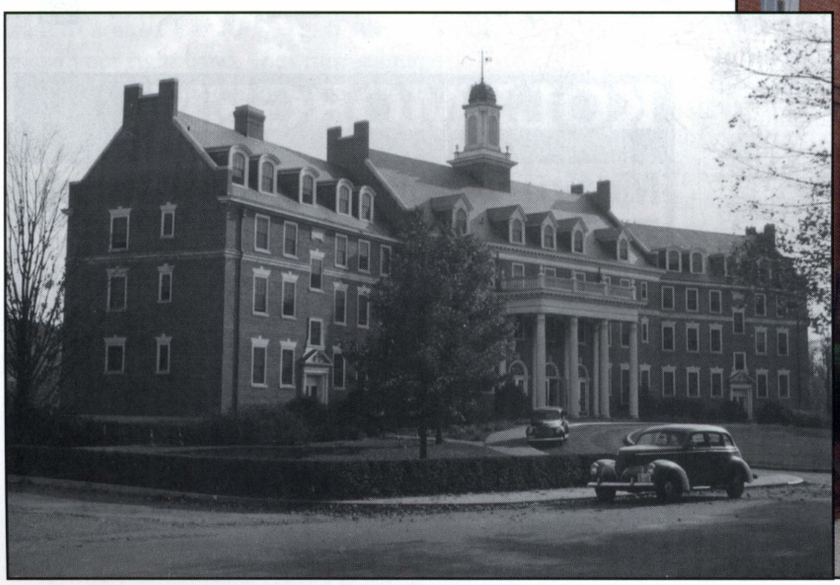
Above: Yearlong festivities to celebrate the 125th anniversary of Tech began with a bang.

Right: Lane Hall, located in the upper quad, maintains an aura of the past.

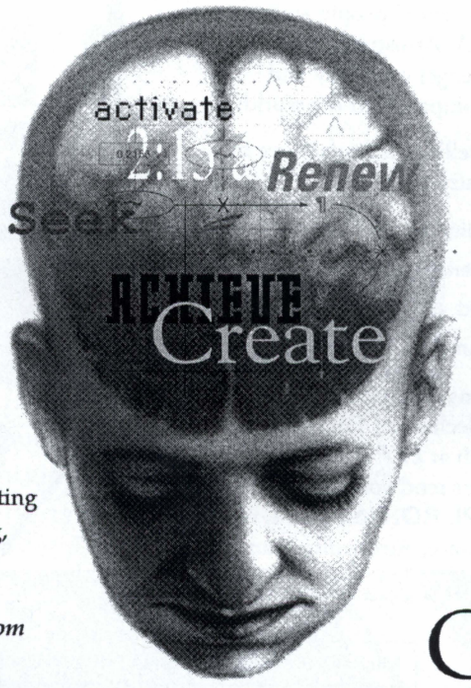
Below: This recognizable building is now known as Alumni Hall. At one time it was a faculty housing building.

Continued on page 26.





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Challenges For A Changing World

Mir-ly Trouble

By Ray Easterling

The near future of manned space occupation teetered dangerously this summer as problems aboard the Mir space station have further strained the consortium of nations building the international space station.

On June 25, an overloaded cargo ship rammed the Mir's hull during manual docking. The impact ruptured the Spektr module forcing the crew to retreat and seal off the damaged section, resulting in a severe loss of power to the station's systems. This follows other mishaps and accidents aboard the Mir, including a fire on February 23 which lasted several minutes and forced the crew to don gas maks. In March, both of Mir's oxygen generators failed, forcing the crew to utilize oxygen canisters similar to the one which burst into flames just one month prior.

Life aboard the beleaguered Mir has been symbolic of the trying U.S. - Russian space partnership. More Russian troubles on the ground are hampering U.S. - led efforts to get the new international space station into orbit on schedule.



Work has ceased on a critical component of the $60 billion facility due to Russia's failure to pay aerospace contractors. The cash-tight Russian government is responsible for finishing a very important part of the station — the component required to keep the station from falling out of orbit.

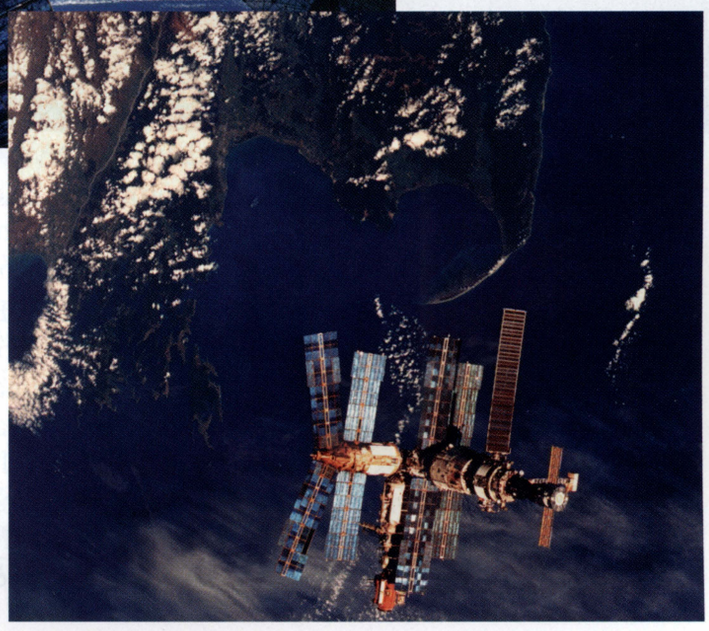
The first portion of the station, originally slated to be launched in November, will now probably not lift off until mid-1998 due to the unfortunate delay.

Unfortunately for the international station's supporters, both the Mir problems and Russian production delays have opened the doorway for Congressional opponents of the station.

While criticized for relying on the other major space power, NASA cannot build the station without Russia, which will launch 44 of the 73 rocket flights required to ferry the hardware, people and supplies into space and which holds a key role in construction.

The first piece, an orbital tug financed by the U.S. and built in Russia, and the second

continued on page 24



BY RYAN MCCLANAHAN

CAVE... Cave Automati
CAVE..

No Bats In This CAVE!

Virginia Tech is a name that is often mentioned as a university that is on the cutting edge of technology development, One of these developments will be coming to campus along with the new freshman this fall.

This technological advancement is the CAVE™. But this isn't your normal damp, bat-filled cave... the only bats flying by your head will be virtual bats. CAVE™ stands for Cave Automatic Virtual Environment, and it can literally put the user in control of his or her own personal world.

The new CAVE™ is a 10-foot cube which surrounds the user or users with an image that is projected onto mylar walls. This is done with a high-resolution rear projecting video system. This multi-user room is the shell for a fully immersive virtual world which the user can manipulate and move freely through with the touch of a button.

One of the best features of the CAVE™ is that the images are not limited to the edges of the cube. The image can actually be floating inside the cube. Visualize a car being projected into the CAVE™. You can walk around the car and get the full view of the car, just as if you were dreaming of it in a showroom. Unlike the showroom you can then walk through the door, without opening it, and view the dashboard and interior. This technology could yield many fascinating possibilities, from walking through a new factory before it is actually built to interactive movies where the dinosaurs run by or even through you.

Though the CAVE™ would make a wonderful addition to the local arcade, the leaders of the project, Dr. Ron Kriz and Dr. Debby Hix have other uses for it. As Kriz states on the CAVE™ web page, the CAVE™ will "build a bridge between research and education." Kriz, a professor from the Departments of Materials Science Engineering and Engineering Science and Mechanics, focuses on the CAVE™ project through the lens of education with emphasis on visualization, while Hix, from the Computer Science Department, deals mainly with human-computer interaction development.

Kriz, a professor in both the Departments of Materials Science Engineering and Engineering

Virtual Environment... CAVE... Cave Automatic Virtual Environment... Cave Automatic Virtual Environment... CAVE...

Science and Mechanics sees the CAVE™ as a valuable tool to aid visualization of complex images or concepts. Instead of looking at an image in a textbook, a group of students can now go into the CAVE™ and have the entire 3-D image projected into the middle of the room. If the students want to look at the image from a different perspective they can walk through the image to the other side and see it in a whole new way. Another definite plus for the CAVE™ is that this technology is useful to many of the disciplines on campus.

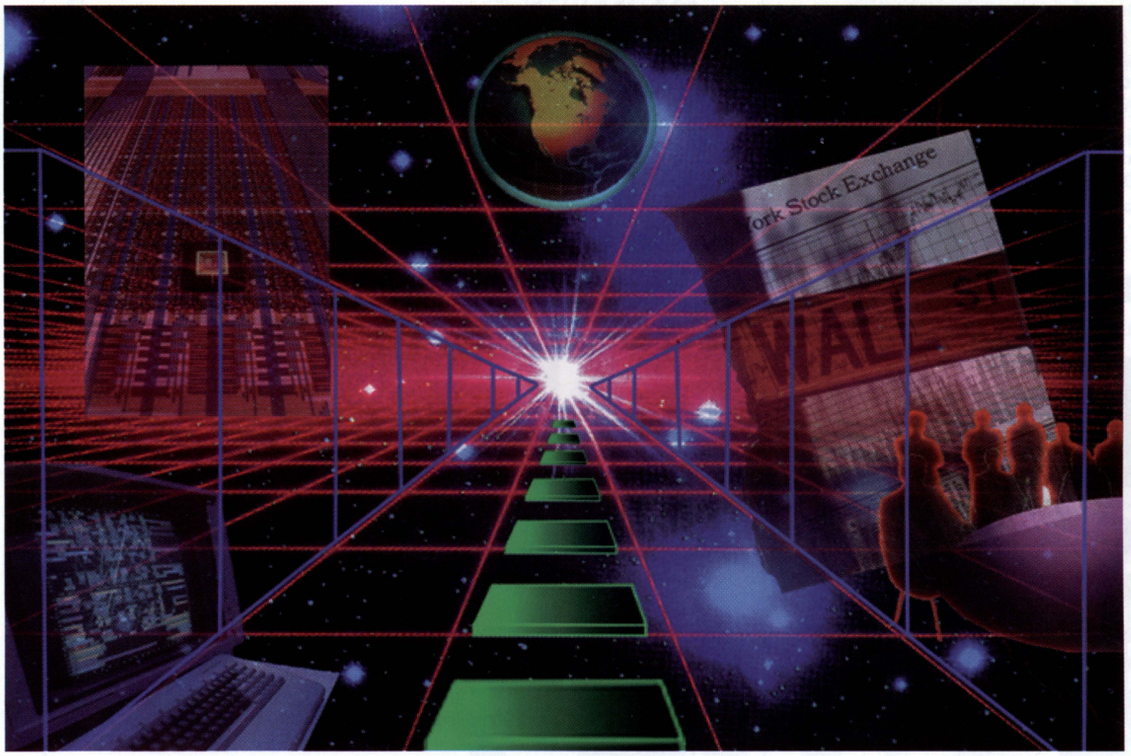
Kriz states, "With CAVE™ technology both researchers and educators have an equal opportunity to explore and learn about the relationships between properties and complex 3-D structures in many disciplines, including biology, biochemistry, architecture, veterinary medicine, fluid mechanics, interior design, art, and materials science."

The possibilities are only limited by the creativity of the user. Civil engineers could build a bridge and walk across it in a virtual environment, or veterinary medicine students could perform surgery on a virtual cow.

The CAVE™ will also be a wonderful proving ground for HCI research. This area of research is one in which Virginia Tech is internationally outstanding, and the CAVE™ research will help HCI developers continually improve these environments to increase their usefulness to the user. This is the major focus of Hix, who is a professor of Computer Science.

Hix wants to use the CAVE™ to test different aspects of a virtual environment, such as the effectiveness of the virtual environment in application and the usefulness to the user. This evaluation of the virtual environments ensures that new developments are continually better for the user.

"The goal of much work in virtual environments, to date, has been to produce 'gee whiz' technology, with almost no attention to its users. An underlying assumption seems to be that these environments, just because they are a novel and impressive technology, are inherently better from a human's perspective. We anticipate that our CAVE™ research will help move beyond this flawed assumption, so that virtual environments in the near future are more effective and efficient for their users, not merely new and different," Hix explains.



Mitch Hazam

The CAVE will allow users to select their environment and can be used as an aid to classroom discussions.

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Forum Fares Well at Nationals

By Ray Easterling

The *Engineers' Forum* continued its tradition of winning excellence at the 77th annual Engineering College Magazines Associated convention.

The *Forum* placed third in the nation for best all-around college engineering magazine. The independent magazine, produced solely by Virginia Tech students, has placed in one of the top three spots for the past four years.

"It's nice to see that we're developing something of a dynasty here," said Ray Easterling, former executive editor of the *Forum*. "We have a lot of talented people on staff who are committed to putting out a great magazine. That makes all the difference in the world."

The *Forum* took a total of 11 awards in the 15 ECMA categories, including awards for best editorials, best covers, and best all around single issue.

This year's convention was held at Tech. Staff members from the Forum worked many hours organizing the event.

"It was difficult getting everything to mesh together without giving myself a headache, but in the end it all worked out very well. I think the convention was a big success. We all learned a lot of techniques to improve the quality of our magazines and we enjoyed seeing old friends, " commented Steffanie Liskey, the 1997 ECMA Convention Chairperson. Liskey continued, "I look forward to next year's convention and hope that more schools will realize the benefits that come along with ECMA membership."

Along with award banquets and student outings, the delegation also attended workshops related to magazine development, including seminars by the former editor of Omni, Keith Ferrel, and Popular Mechanics Graphic Coordinator, Bryan Canniff.

Also, the delegates voted Mike Dorcey from Kansas State University into the organization's secretary position.

"I'm glad Dorcey is taking an active role in ECMA," said Jim Agniel, former editor of the KSU Engineer. "He is excited to help guide the group into its newly-defined purposes. I think he's going to offer some of the continuity we've been missing over the past several years."

The Wisconsin Engineer bid and won the right to host the 1998 conference in Madison, WI.

"The ECMA conference was a great success," Agniel said. "Once again we showed that engineering students can and do manage efficient businesses that create high-quality publications." EF

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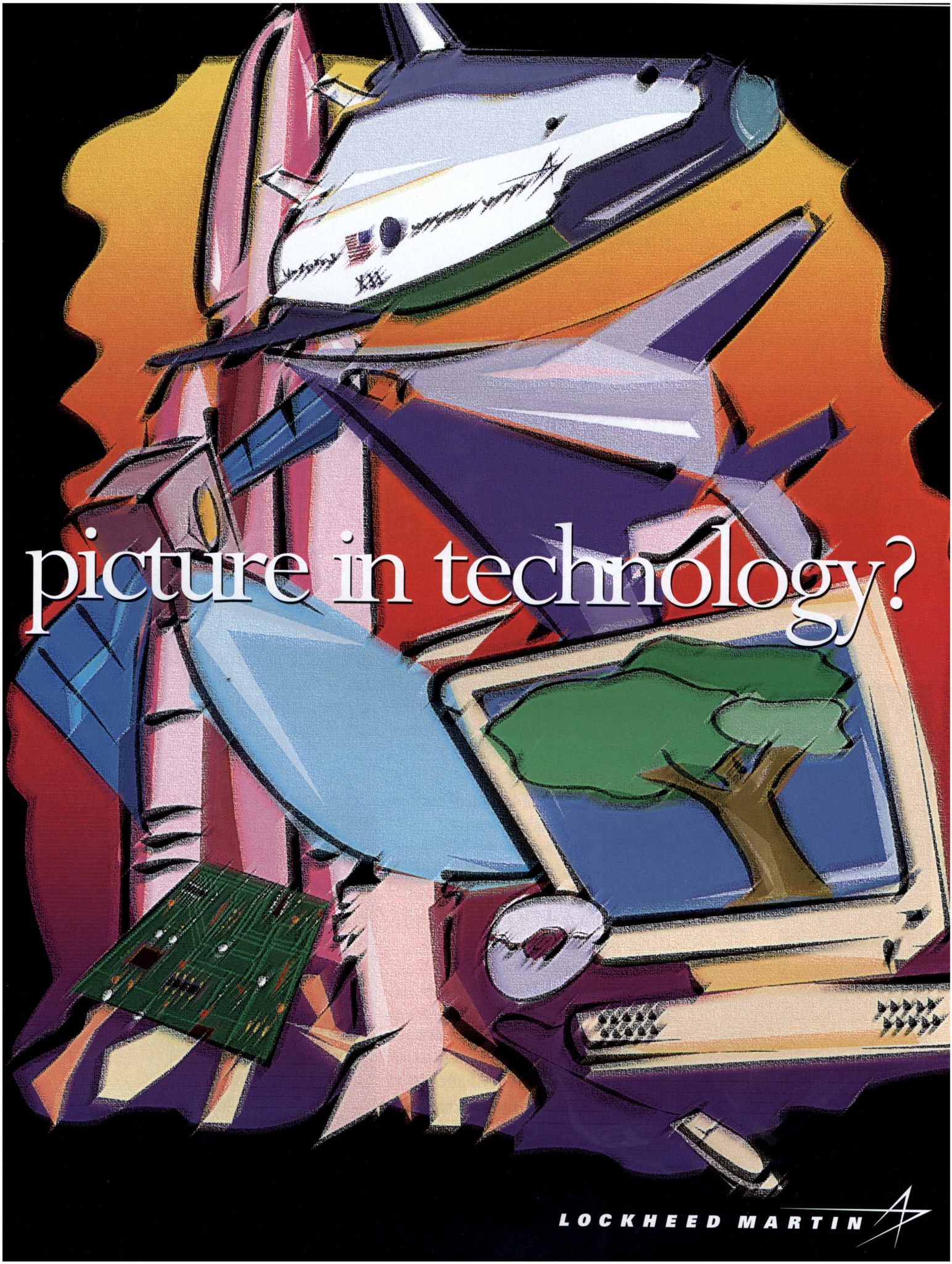
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are both on schedule. The third module, the Russian-funded service module originally scheduled to launch in April 1998, is the main problem.

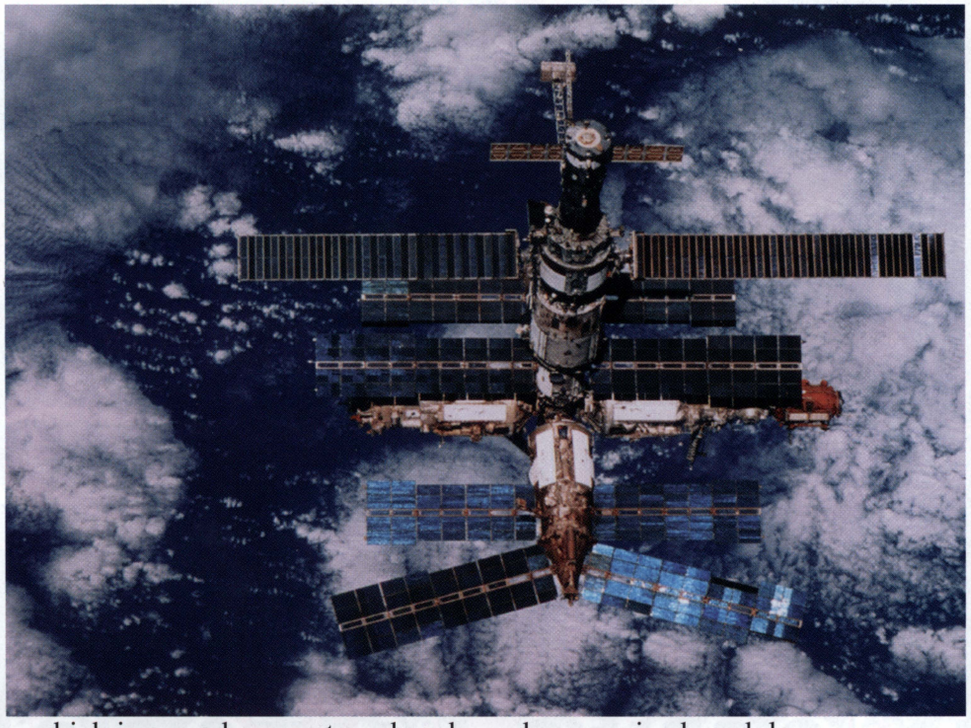
"The real question is whether the Russians will ever get the service module done." said Rep. James Sensenbrenner, Jr., chairman of the House Science Committee. It appeared little work had been done since his previous visit 13 months prior, Sensenbrenner said.

"It's a big mess," he said.

NASA is currently looking at modifying the tug component so it could fill in for the service module should more delays occur, or should the Russians default altogether.

The completed facility is to weigh 924,000 pounds, span more than 120 yards, and include seven laboratories and a dormitory for a constant crew of six.

Of the $60 billion price tag, which is spread across two decades for all participants, the U.S. will pay $45 billion, including shuttle launches and monies paid to Russia for space goods and services. Such services include the extended tours by American astronauts aboard the troubled 11-year-old Mir as the crews develop new techniques for building the international station.

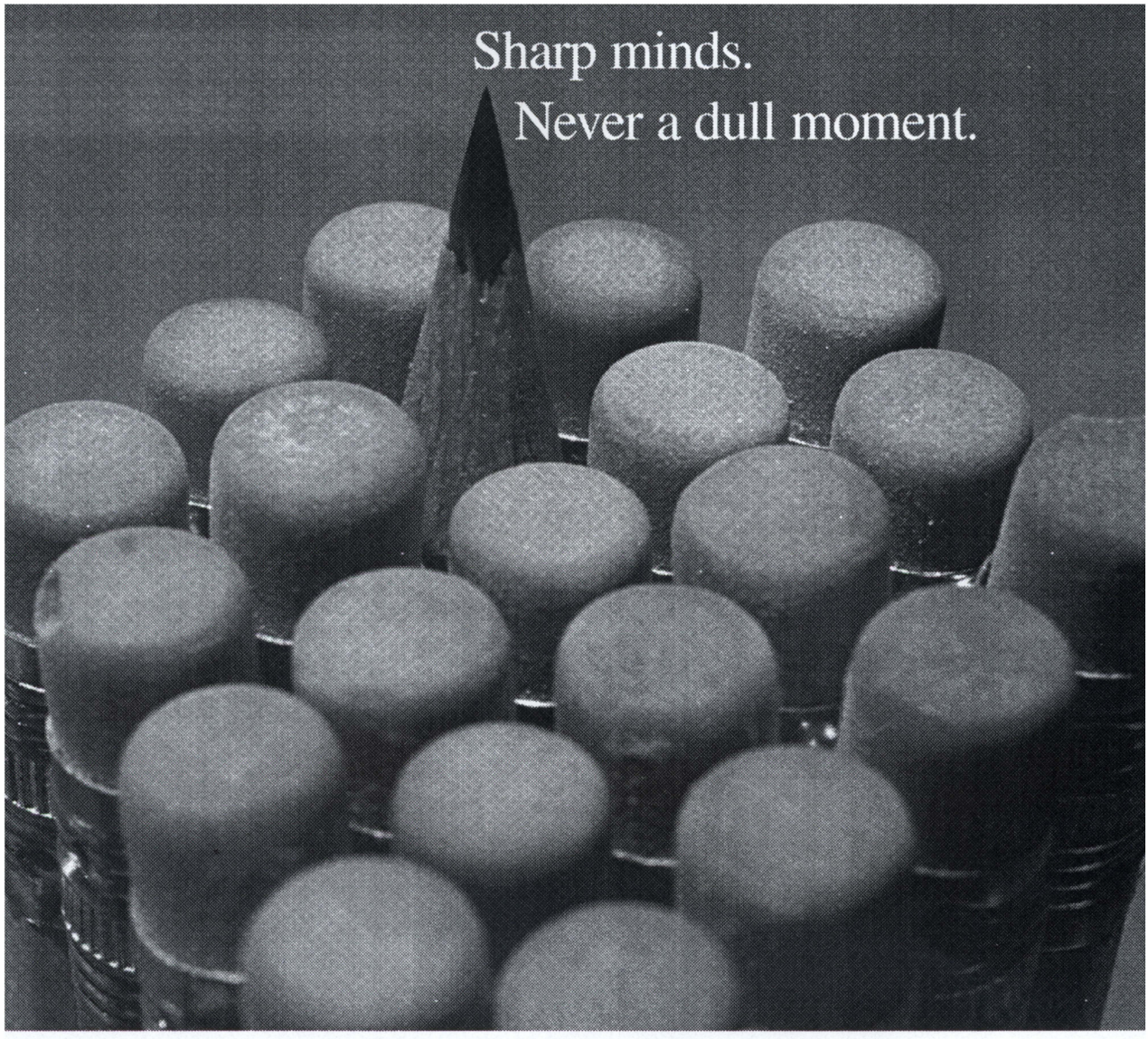




Regarding the Mir, two replacement cosmonauts have boarded the station, trained for the tricky task of repairing the damaged Spektr module. Repair work was scheduled to begin August 20, when Commander Vladimir Solovyov and Pavel Vinogradov will attempt to reconnect the severed power cables during a space walk inside the depressurized module.

American Foale will return in late September or early October when replaced by American David Wolf during a Mir docking with the U.S. space shuttle Atlantis.



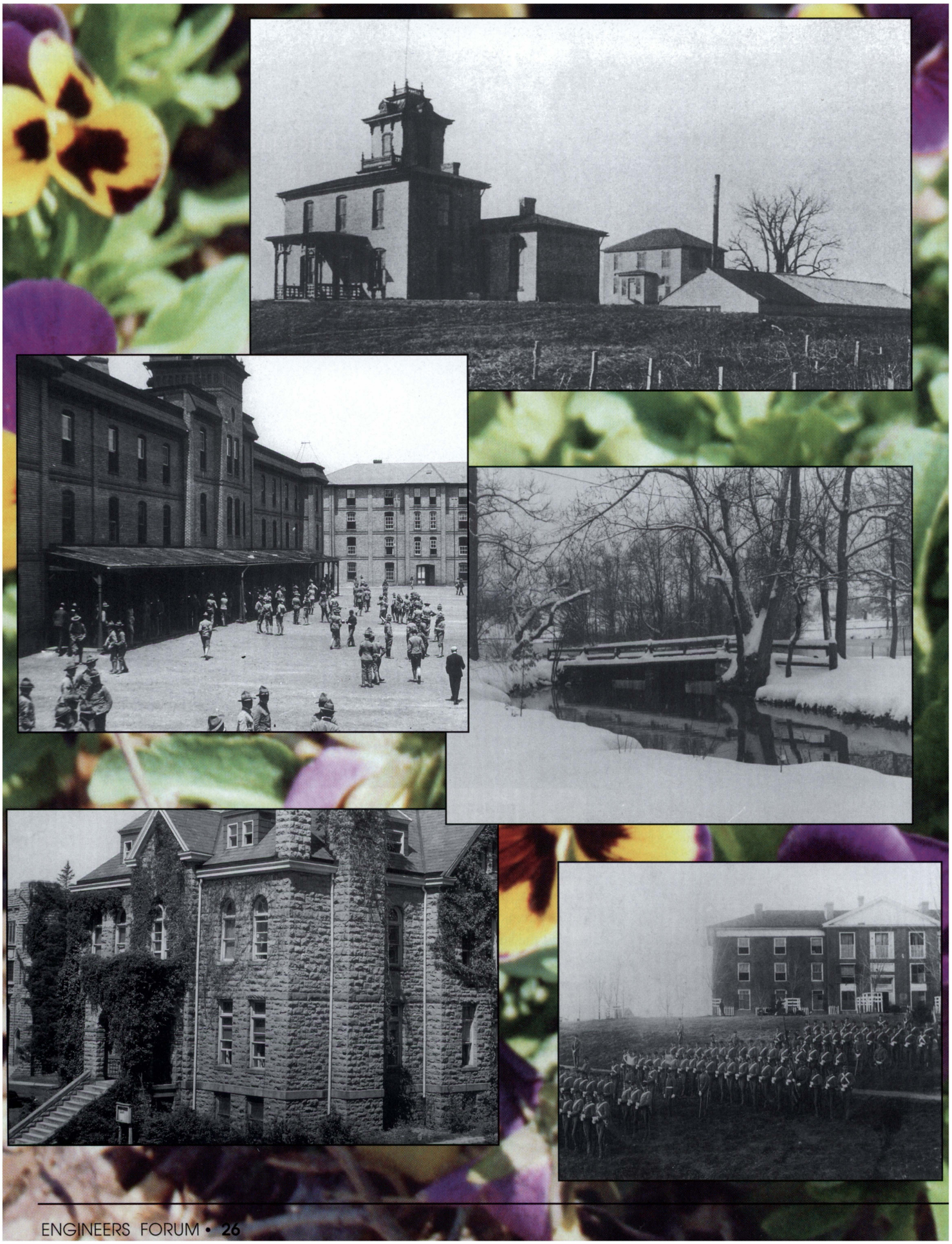


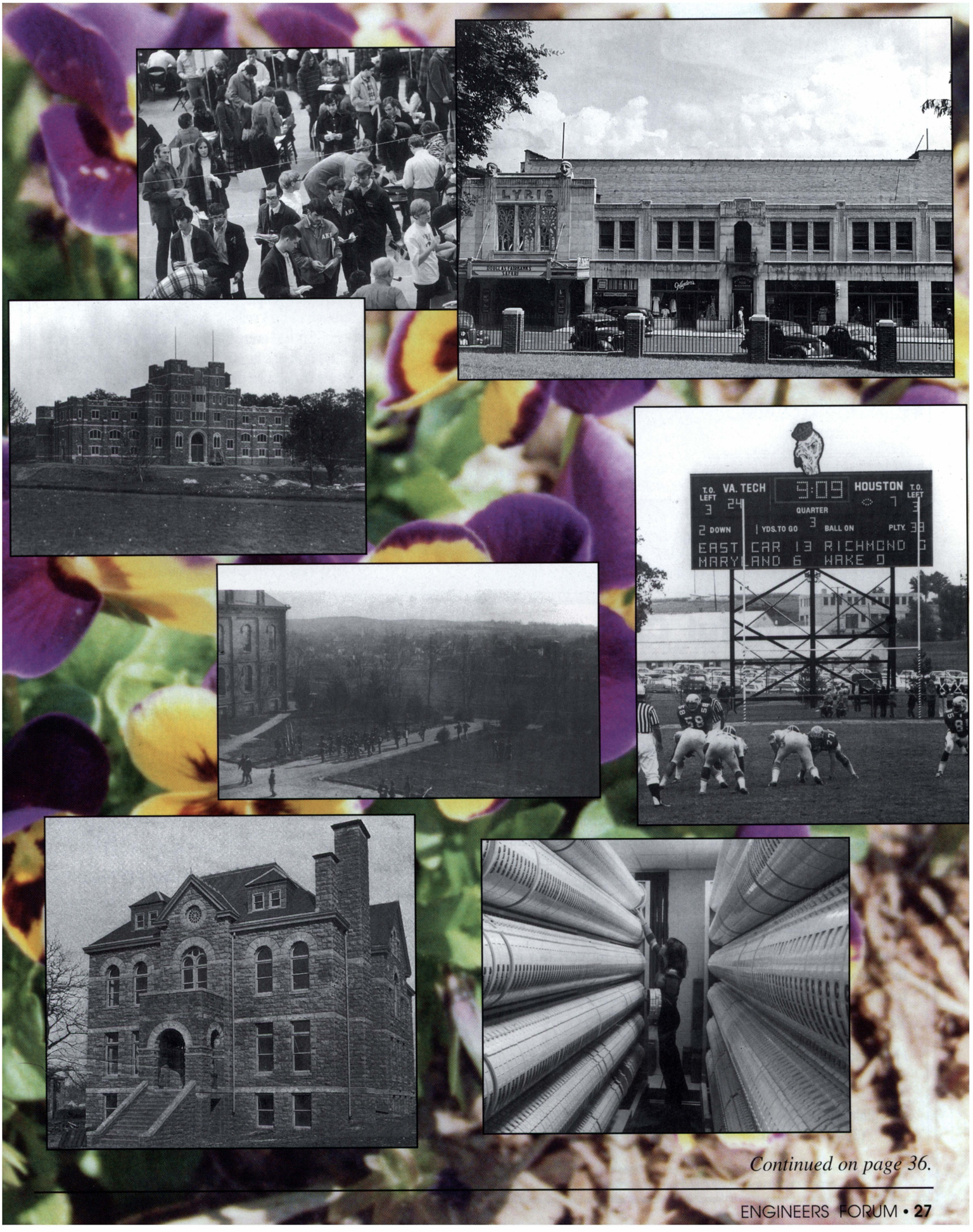
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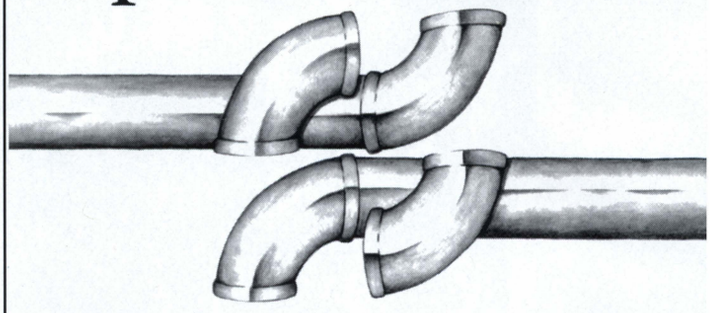
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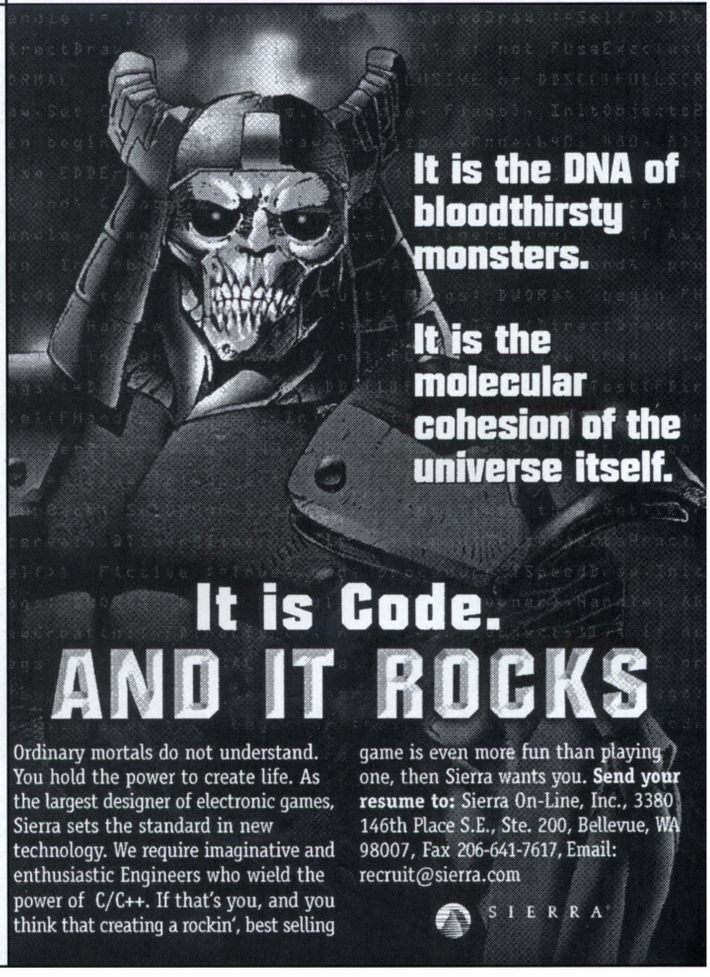
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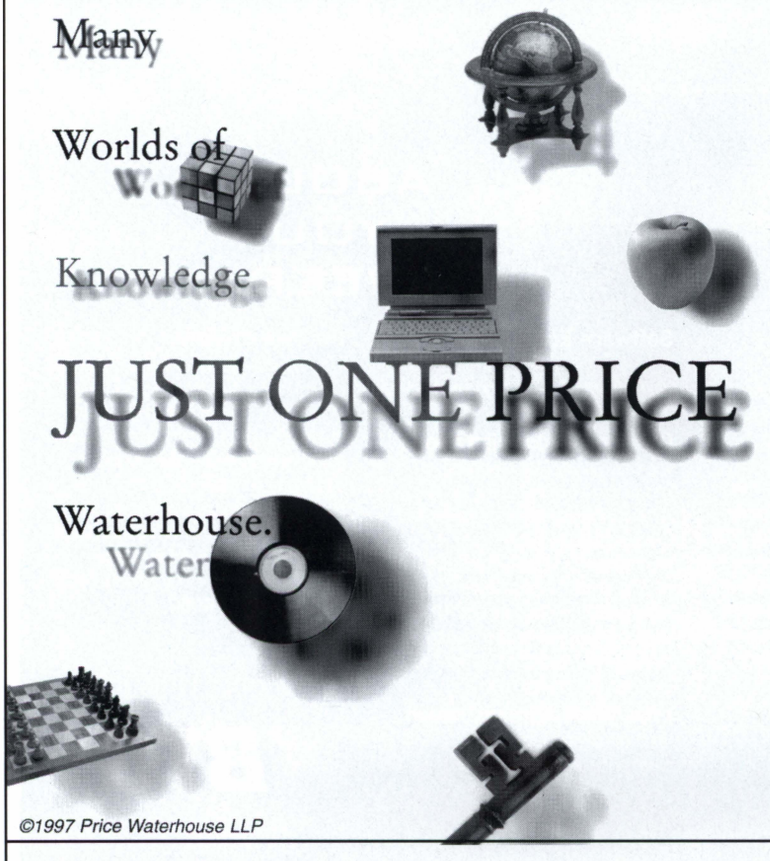
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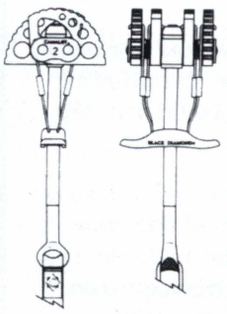
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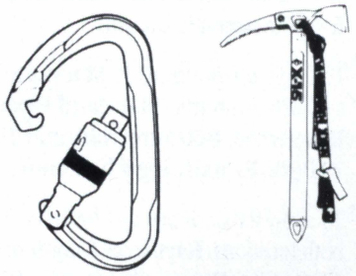
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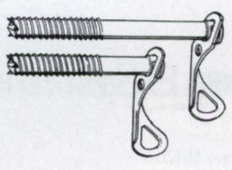
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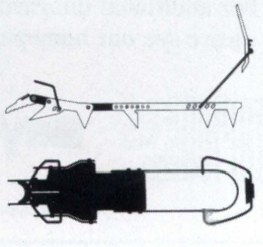




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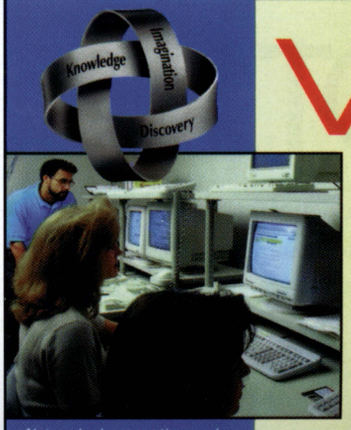
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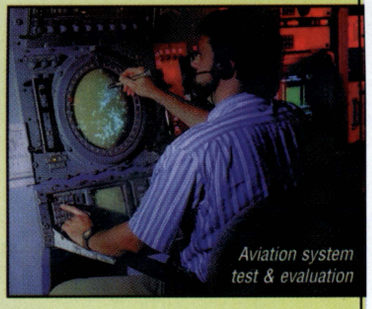
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Message from the President

This year marks the 125th anniversary of the university's founding as Virginia Agricultural and Mechanical College in 1872. The land-grant concept has contributed significantly to the quality of life Americans enjoy today. However, our institution was not born under promising conditions. VAMC (now Virginia Tech) rose from the ashes of the Civil War, during the Reconstruction, when government was a confusing mixture of carpetbaggers and untested legislators. On occasion, I remind myself of that era as I leave for Richmond. It is helpful.

No less than 24 Virginia colleges vied for the federal scrip that would fund this untested conception — a land-grant college. Believe it or not, even the University of Virginia wanted to become Virginia Tech. Years of political wrangling ensued before a proposal from a little known Methodist school in Blacksburg dropped onto the desks of legislators. Probably as a compromise, the impoverished Preston and Olin Institute became the Virginia Agricultural and Mechanical College — the commonwealth's land-grand college.

These new land-grant institutions were egalitarian and accessible to those of modest means. They stressed practical education as well as the classics, agriculture as well as philosophy. And they offered Extension services across the state. Business graduates founded banks; engineers built railroads. But it is in agriculture, in the reduction of hunger, that the contribution of these institutions has been most impressive. Even today, hunger is the predominant concern of most of the world's population.

In 1860 one farm worker fed four and a half people. Today one U.S. farmer feeds more than 100 individuals. Contemporary American consumers spend less than 12 percent of their disposable income on food, the lowest in the world. The land-grant college system, including Virginia Tech, plays a major role. Beginning as a small college devoted to engineers and agriculturists, Virginia Tech has now completed the transformation to a full-fledged research university. And in the last decade Tech has emerged as a leader in information technology. Cyber school courses abound on campus. We are partnered with Bell Atlantic and Sprint to "network Virginia" and make possible the connection of public agencies, including the secondary school system via a broadband network. Tech helped Blacksburg become an electronic village; now we are helping the commonwealth become an electronic state.

There will be changes in the way we deliver education in the future. New technologies will alter the limitations set by space and time. But information technology will enhance rather than replace the professor in the classroom. It has been suggested that higher education is in danger of becoming a commodity. But neither technology nor the Internet will replace the university campus and the classroom. Intellectual discovery is stimulated by a campus environment.

For the undergraduate experience, I doubt that there is a substitute for the "kid in a candy store" experience of roaming the library's stacks or having coffee with a favorite teacher or serving as president of a sorority or being a resident advisor in the dormitory or forming the lifelong friendships that inevitably begin at college.

As the years pass, I find satisfaction in the likes of an e-mail message I received from a student of 30 years ago who, referring to my course, said. "While I didn't excel, the subject matter still made a lasting impression. The course has proven extremely useful to me over many years. It is my understanding that you are still teaching that course. My daughter, who is a junior at Virginia Tech, is interested in taking your course." That note of thanks, that course recommendation, is to me what a university is all about. It will not be replaced by the Internet.

And so we proceed in this, our 125th anniversary year. We celebrate where we have been, but we are not constrained by this history. We look forward to the next millennium.

Paul Torgersen



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As we communicate in ways unimaginable twenty or even only ten years ago, the world around us has become a laboratory. And the politician's have decided to dabble with science and technology, dissolving the boundaries further still.

When Micheal Crichton's novel *Jurassic Park* became a hit movie four years ago, most people did not consider cloning to be a political matter. Yet, last spring, President Clinton signed legislation restricting the limits of cloning research and experimentation. To President Clinton I say, "Bravo!"

Today's issue of cloning is simply a modern day example of Mary Shelley's novel *Frankenstein.* The message in that book... don't mess with science because one day you will create a monster. Anyone who thinks that a restriction on cloning humans is a set-back for medical science has not yet

Time after time the politicians prove that science no longer belongs to the scientists.



Photo courtesy of NASA

considered all the possibilities. New techniques and technologies are consistently being produced to treat and cure many diseases that were at one time a death sentence.

A second instance where science felt the presence of the lawmakers breathing down on them occurred this past summer as trouble arose with the Mir Space Station. In congress, one representative felt the need to blame the problems on NASA's decision to work with the Russians. This is an unfair statement. Would it have been any smarter for us to work with France or Germany? Of course not.

But the blame must be put on somebody's shoulders.

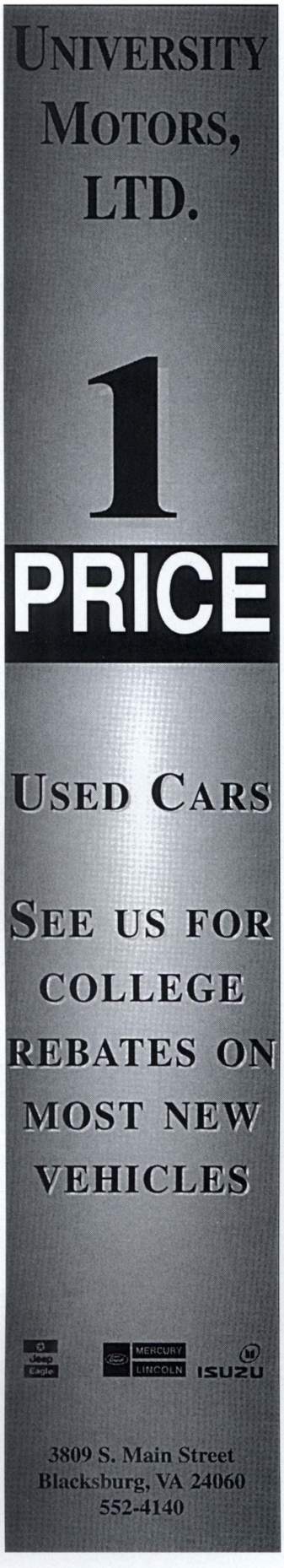
In fairness to everyone, it was not wise for NASA to work with the Russians from a financial standpoint because of the economic problems recently troubling Russia. However, from a technological and scientific standpoint, the russian space program was an ideal partner for building an international space station.

And even for a third time this year, politics has played a part in expanding the horizons of science. On this country's Independence Day, we landed a rover on Mars so that could explore the foreign territory that mystifies us all. Was this not, in its own silent way, another political statement?

Time after time the politicians prove that science no longer belongs to the scientists. Instead it is the hands of the lawmakers. The social scientists.

Steffanie Liskey

Executive Editor, 1995-1997



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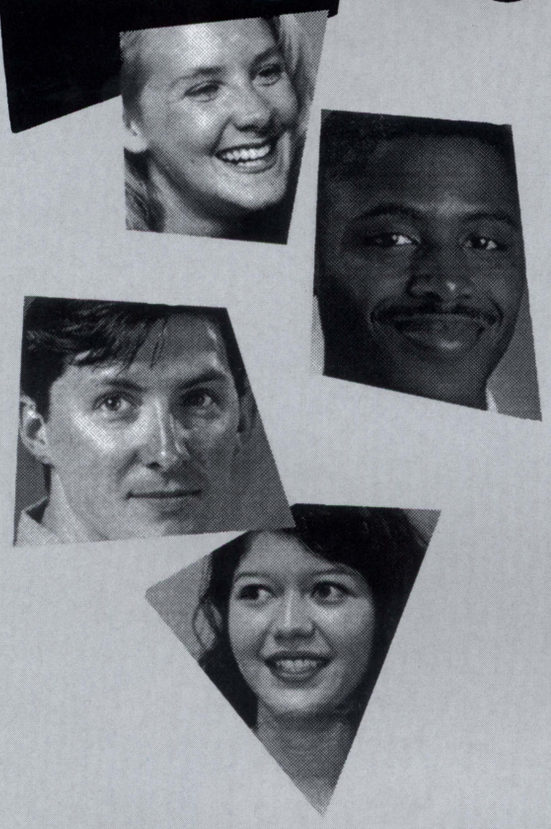
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