Georgia Tech

FALL 1992 ALUMNI MAGAZINE

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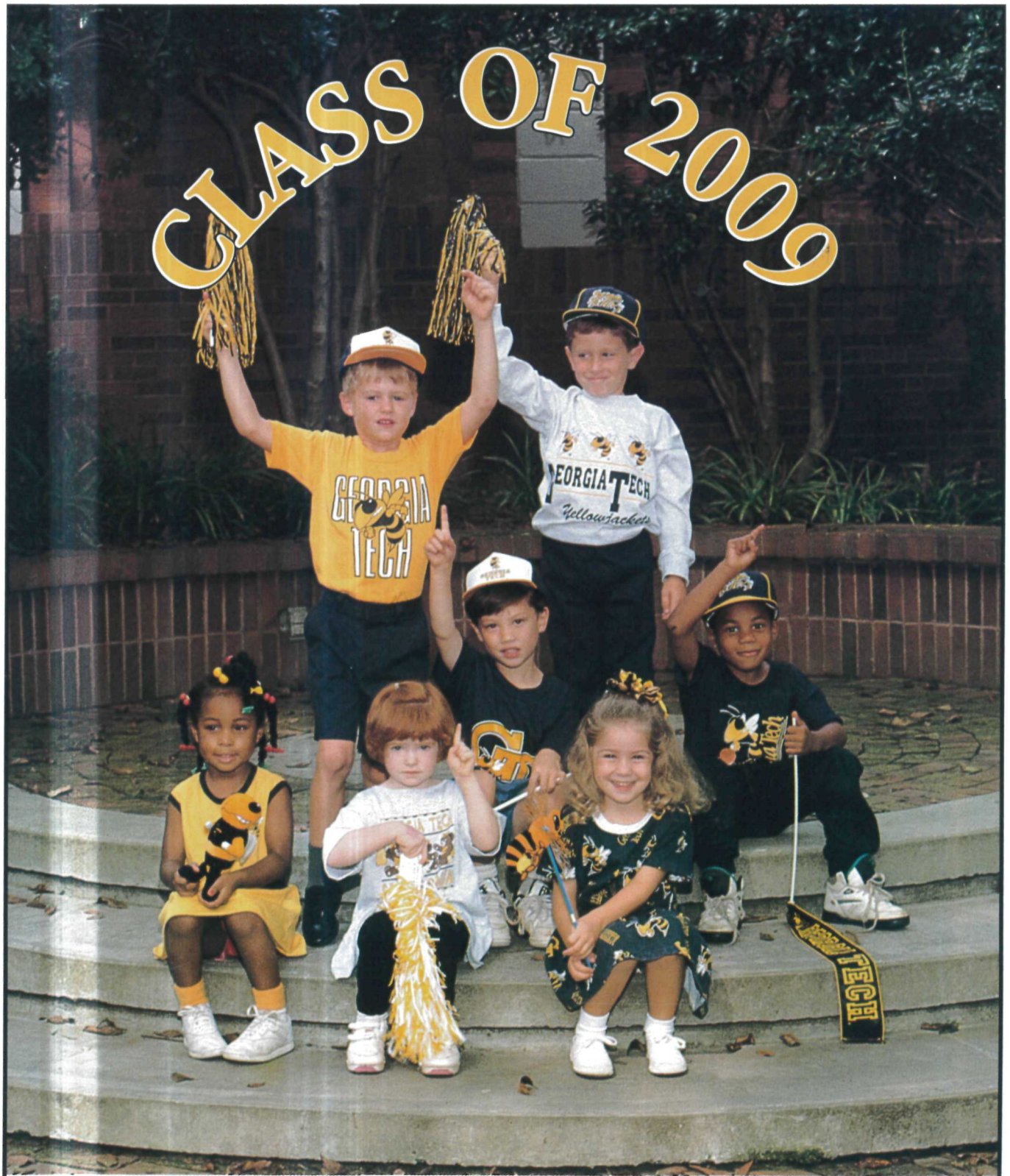

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Georgia Tech
ALUMNI MAGAZINE

Volume 68, Number 2 • FALL 1992

COVER: *Buzz lies in traction awaiting a krypton laser beam that will create a hologram from the model of the mascot. But holography is a lot more than just a way to create dazzling display art. See the story beginning on page 16.*

Features

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Letters

Remembering Junior's

Editor:

The item "Good News, Bad News" ["Technotes," summer 1992] brought back pleasant memories.

I remember Junior's Grill being on North Avenue, next to a movie house, when I was a student. When the class rings were delivered, I did not have the money to pick up my ring. The man who ran Junior's loaned me the money so I could claim my ring.

I knew this man only by my going to the grill many times for breakfast. Being a yankee, I would order eggs and bacon or sausage, and add, "hold the grits." Every morning, without exception, I got my eggs—plus a big pile of grits.

I wear the ring every day, and still have the box it came in with the price tag attached—$33.54.

However, I still do not care for grits.

LeRoy J. Smith, CE '51
Harlingen, Texas

Discovering a Familiar Landmark

Editor:

I read the article about DramaTech's new quarters ["Technology Takes Center Stage," summer 1992] with a great deal of interest and nostalgia.

I grew up in northwest Atlanta, and as a teenager attended O'Keefe High School in the late '40s and early '50s. I also occasionally attended Sunday School at the old Hemphill Church of God, which was later to become home to Tech's drama group.

I also remember Lester Maddox's Pickrick, which was only a few yards north of the church. In those early days, the Pickrick was not a restaurant but simply a small ice cream parlour.

Although O'Keefe was

on the edge of the Tech campus, I never considered that one day I would be a student on the other side of the street. Fortunately, three years after graduating from high school, I was admitted to the 1954 Tech freshman class.

In all, I spent 10 years on the end of Techwood Drive. I watched the North Expressway being built, and I also ate my share of Varsity hot dogs.

After graduation, on one of my visits to Atlanta, I arranged to meet a young engineer who had worked for me at Gulfstream Aerospace in Savannah. It was Christmas night 1979, and my friend wanted to drive around campus to see how much had changed since the '50s.

Though there were many familiar sights, many were new to me. We finally came to a stop sign, and I looked across the street at an old red-brick building with stained glass windows. We sat there for several seconds before I realized we were in the middle of Hemphill Avenue, and this was the old church of my youth.

John A. Flinchum, ME '58
Dhahran, Saudi Arabia

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TechNotes

Written by Gary Goettling

Roll Call Goal: Five Come Alive!

Roll Call volunteers and staff members are hoping that 5 is their lucky number this school year.

The goal for the 1992-93 campaign, which runs from July 1 through June 30, 1993, is $5,555,555 from 26,000 donors.

Hubert L. "Herky" Harris, IM '65, vice president for Roll Call, chairs the fundraising effort, Georgia Tech's largest source of unrestricted gifts.

This year's theme is "Together, Everyone's Contribution Helps," which is meant to emphasize that "every single contribution, no matter how large or small, is important," says Pam Cottrell, assistant director of Roll Call.

"Raising money during tough economic times is never easy, but we are confident that Tech alumni, friends, faculty and staff will pull together."

Now in its 46th year, Roll Call money provides scholarships, fellowships and funds for curriculum development.

Last year's drive netted a record $5,028,668.

Twist and Shout

Dean of Students Emeritus James E. Dull, far left, strums along with the other members of the "Beatles" in this circa 1964 photograph sent in by Tom Hollingsworth, EE '65. The other members of the group are Mike Mulligan (center) and Ed Kohler, with Lucien "Buzz" Hope on "drums." The occasion was a talent show organized by co-op students. "Summers were long back then," Hollingsworth writes.

Best Buy

Money magazine has ranked Georgia Tech near the top in its third annual list of the 100 best college buys. Tech placed seventh in the survey, which ranks private and public universities on the basis of 15 criteria such as student-faculty ratio, average SAT score, graduation rate and alumni business success, based on Standard & Poor's *Register of Corporations, Directors and Executives.*

Ivan Allen Dean

Dr. Robert G. Hawkins has been named dean of the Ivan Allen College of Management, Policy and International Affairs. A professor and dean of the School of Management at Rensselaer Polytechnic Institute in Troy, N.Y., Hawkins will assume his new duties in January. Prior to being named dean at Rensselaer in 1984, he was vice dean of faculty of business administration at New York University. Hawkins earned an AB from William Jewell College in 1958, and pursued graduate work at New York University, where he received a PhD in economics in 1966.

Architecture Dean

Dr. Thomas D. Galloway became dean of the College of Architecture on Oct. 1. Galloway had been dean of the College of Design and director of the Design Research Institute at Iowa State University since 1985. Previously he

TechNotes

Continued from page 9

New Research Center, Olympic Hopes

was an associate dean of the School of Architecture and Urban Design at the University of Rhode Island. Galloway earned a bachelor's in sociology from Westmont College in 1962, and did his graduate work at the University of Washington, where he received both his master's and PhD in urban planning in 1969 and 1972, respectively.

Sunny Center

Georgia Tech has been assured of its place in the sun since being selected to house the University Center of Excellence for Photovoltaic Research and Education. The center, funded through Sandia National Laboratories, will advance research in solar-cell technology and provide assistance to other universities with solar energy research programs.

MAC Parties

The apparel at one Halloween-night party won't be traditional ghosts and witches, but the latest in fashion design. The Alumni Association's Minority Affairs Committee is sponsoring a fashion show on Saturday, Oct. 31, at 6 p.m. in the Student Center Ballroom. The affair includes a committee presentation. The fashion show will be choreographed by Andrea Price, IE '91, and Michele Crawford, IMGT '84, and is one of several MAC Homecoming activities that includes a pizza party on Friday, Oct. 30, at 7 p.m. in the Weber Building on campus.

The group will hold a reception at 5 p.m. in the Student Center Ballroom. On Sunday, MAC members and friends are invited to gather for brunch at Ray's on the River in Marietta. For more information call Laticia Khalif at (404) 494-4081.

Ciraldo Retires

Al Ciraldo, the voice of the Yellow Jackets since 1954, has retired as the play-by-play announcer for Tech football games. He will continue to work the pregame, halftime and postgame shows on WCNN radio. Over his career, Ciraldo, 71, announced more than 1,000 basketball games and 416 football games, beginning with Tech's 1954 opener against Tulane. Bob McCann, WCNN sports director, takes over the play-by-play, with Kim King continuing as analyst.

Olympic Perspective

Four years from now, Brian Jacob expects to be back on campus, but lifting iron instead of textbooks.

A civil engineering senior, Jacob was a member of the U.S. Olympic weightlifting team in Barcelona. "The whole experience was incredible," Jacob says. "Sixteen days of the best athletes in the world, all in one place competing."

And what of the unflattering comparisons that have been made about Atlanta's cultural offerings compared to those of Barcelona? As an Olympian, Jacob felt that Barcelona's many tourist attractions, while spectacular, were somewhat "distracting."

"People were more interested in sightseeing than in seeing events," he says.

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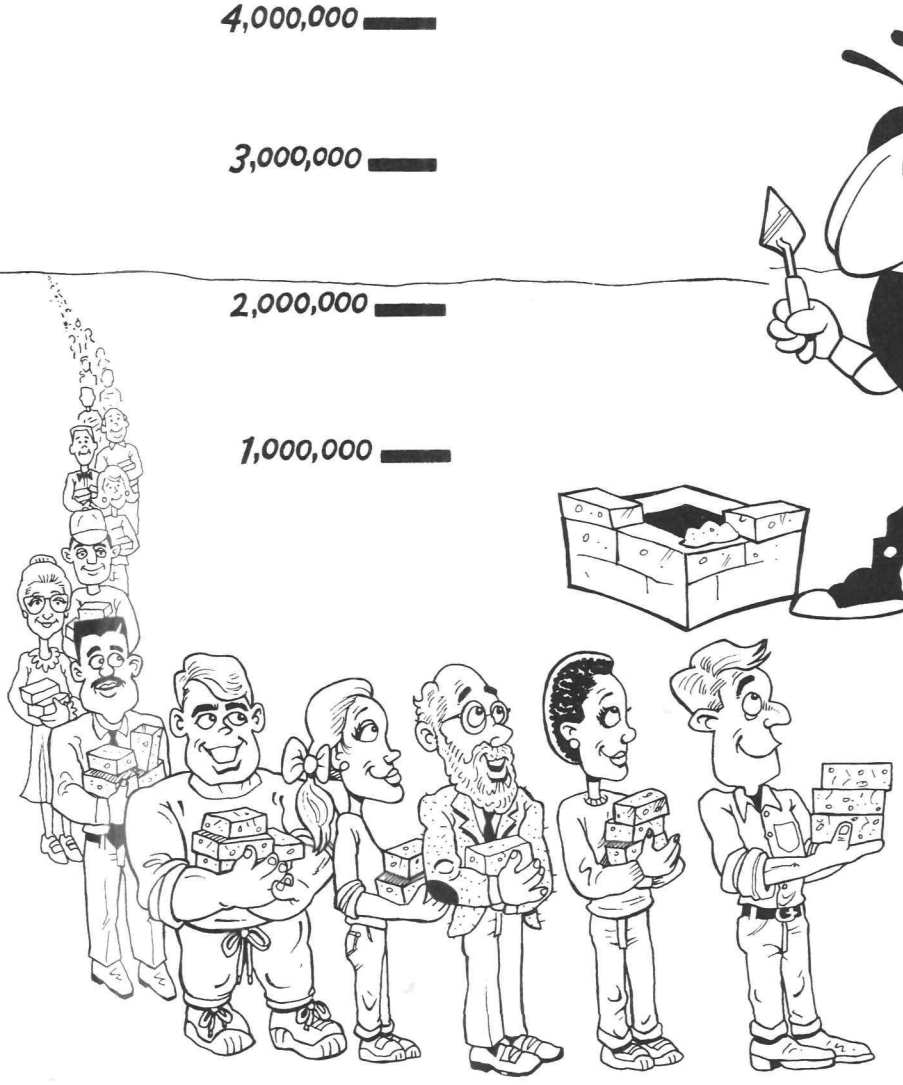

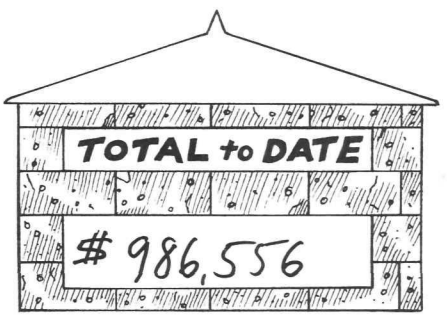

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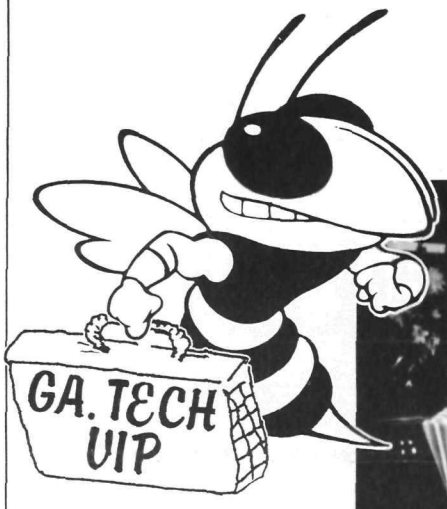

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Tech Graduate, Husband on Endeavor Mission

Jacob finished 18th out of 31 in the 60 kilos (132 pounds) category. "I didn't do as well as I'm capable of doing," he says, a situation he plans to rectify in the Atlanta Olympics. He has another wish, based on his experience living in the Barcelona Olympic Village: "I definitely hope they give us air conditioning in 1996."

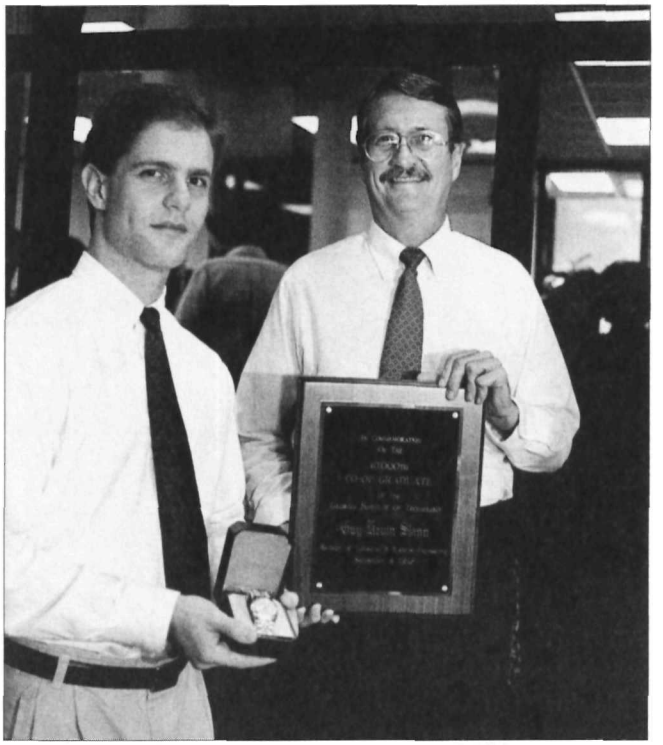
Historic Space Couple

The launch of *Endeavor*, which marked NASA's historic 50th space shuttle flight, was notable for a number of firsts—including putting Georgia Tech's first female astronaut, Dr. N. Jan Davis, Biol '75, into orbit with her husband, payload commander Mark Lee.

Davis and Lee became the first married couple to travel in space, although NASA policy generally prohibits husband-and-wife teams from flying together. The couple, which has no children, married 20 months ago after receiving their *Endeavor* assigments, and NASA officials decided to make an exception. It was no honeymoon flight. The couple worked opposite 12 hour shifts.

The seven-day shuttle flight, launched Sept. 12, also carried aboard the first black female astronaut, Dr. Mae Jemison, and the first Japanese citizen, Mamoru Mohri, to fly aboard a U.S. shuttle.

The flight also carried a menagerie of critters for a variety of life science experiments: Frog eggs were fertilized during orbit to see how tadpoles would develop and react in a weightless environment; hornets were studied to see how they would build a comb—on earth they build toward gravity; and scientists studied the effects of weightlessness on two Japanese carp.



Guy Slann, left, receives a watch and plaque from Bob Kennedy of Delta Air Lines in commemoration of Slann being the 10,000th co-op graduate.

Homecoming Reminder

Homecoming weekend of Oct. 30-31 is fast approaching. Reunions will be held by the classes of 1932, 1937, 1942, 1947, 1952, 1957, 1962, 1967, 1972, 1977, 1982 and 1987. The class of Old Gold, comprised of alumni who graduated in 1941 and earlier, will also meet.

A Young Alumni Homecoming Celebration will be held at the Student Center Ballroom. And alumnus Jeff Foxworthy, Cls '79, will perform his stand-up comedy routine at the Theatre for the Arts. Ticket discounts are available for most reunion class members.

For more information about Homecoming activities, call Catherine Martin at the Alumni Association at (404) 853-0758.

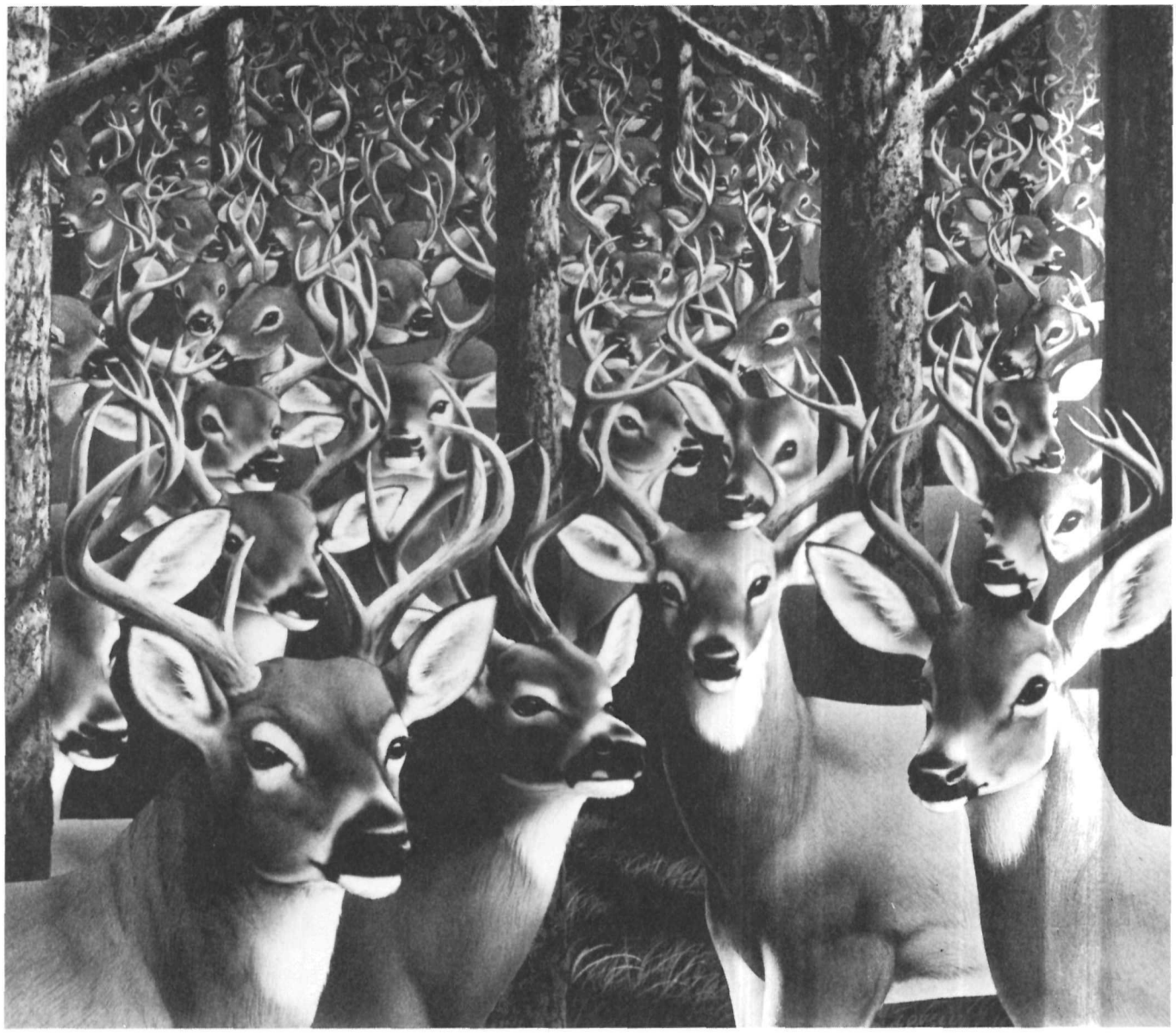
10,000 Co-ops

At fall commencement, Georgia Tech's Cooperative Division observed a significant milestone in its 80-year history when the 10,000th co-op student stepped forward to receive his degree.

Guy Slann worked for Delta Air Lines, first as a mechanical engineering student, later as an industrial engineering major.

"Being a co-op allowed me to see what being a mechanical engineer was all about," he says. "I wrote repairs that put million-dollar pieces of equipment back into service. Seeing tangible results like that gives you confidence."

He also credits his co-op experience with the change in his career focus. "I found out that I didn't want to learn how to keep an engine in service—I wanted to make the entire process of keeping the engine in service more efficient," says Slann, who plans to attend graduate school. ■



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Holography

A Picture is Worth 100,000 Bits

By Gary Goettling
Photography by Gary Meek

The picture of the clown's head seems so lifelike, it's unsettling. As you move past the portrait, he blows a noisemaker that unfurls out into the air. Perhaps it's the picture's greenish cast that gives it a corpse-like eerieness reminiscent of a character in a Stephen King novel. It's easy to become absorbed in the details of the image, and you have to pinch yourself:

This is only a hologram.

From the Greek *holos*, meaning whole, and *graphos*, meaning to write, holography is old technology that is finding new life in areas including security, quality control, marketing, information storage—even fine arts, as in the example of the clown.

At Georgia Tech, researchers are using holographic processes to make computers faster, and capable of storing extraordinary amounts of data. Their studies could help bring movies on demand into homes via fiber-optic networks, hasten integration of computing and video technologies, or bring resources of the Library of Congress into classrooms.

A hologram is essentially a recording of an object taken with laser light. The theoretical framework of holography—that a coherent light source could record images in three dimensions—was developed in 1947 by Dr. Dennis Gabor, who was searching for a way to improve the quality of photographs from electron microscopes. His discovery won for him the 1971 Nobel Prize in physics. But not until the invention of the laser in 1960 did holography become practical.

Holography is possible because of the peculiar nature of laser light. Sunlight is a mishmash of wavelengths of all colors, each wave traveling independently of the others. A laser beam, on the other hand, is coherent, meaning that it possesses a high degree of organization and contains a single wavelength of the spectrum. Early lasers emitted red light because the crystalline structure of rubies was the most amenable to energizing. Since then, scientists have been able to lase almost any substance: other crystals, gasses, liquids—even Jell-O and human breath.

Dime-Size Novels

For more than three decades, scientists have dreamed of exploiting holography as a means of storing and retrieving information. The 30-year holdup has been in finding the "right" medium. But with increasing pressure to make computers faster, smaller and more efficient, the search has been renewed.

The potential is staggering: With the right storage medium, data equivalent to a thousand books could be holographically placed on something the size of a dime. The awesome capacity of holographic storage is also evident in how the data is measured. Computer information is expressed in bits, whereas holographic data is termed pages, with each page containing 100,000 bits or more.

"A lot of research and development is oriented toward the storage material itself," says electrical engineering Professor Thomas K. Gaylord. "There's no perfect material at the moment. Various materials have advantages and disadvantages. There are tradeoffs involved with sensitivity, storage lifetime and the ultimate maximum data capacity."

Gaylord, along with EE Professor Elias Glytsis, is placing holograms inside crystals of lithium niobate in an effort to understand how one hologram affects another, and how stable the information remains over time.

Crystal Pages

The holographic storage process works like this: A laser light is split in two, and one of the rays (reference beam) is bounced off a mirror so that it hits the opti-sensitive storage crystal such as lithium niobate at a certain angle. The other beam (object beam) passes through a device containing a page of data, which is presented as thousands of

Continued on page 18

The hologram of a clown at the Elusive Image gallery in Atlanta contains multiple images, so the clown appears to move as the viewer walks past it.

To make a hologram, a laser beam is aimed at the object or data array, and another is focused on the storage medium. The area where the rays overlap contains all the information about the object.

dark and light spots representing binary computer information. Like light passing through a picture slide, the pattern is projected into the crystal. The points where the two beams intersect (interference pattern) are recorded in the crystal as a hologram.

Subsequent pages are added by moving the reference beam to a slightly different angle. To retrieve a page, the reference beam is aimed at the crystal at precisely the same angle used to store the information. So while the information itself is two-dimensional, the 3-D capability of holography allows data to be, in effect, piled up slightly askew like a stack of papers.

"This is a very interesting and complicated set of processes that depends on the symmetry of the crystal, the physical mechanisms used to move the charge, and the electro-optic effect in the material," Gaylord says. "How the crystal responds is extremely important, and if we don't understand the underlying physical processes and learn to control them, we can't produce the commercial systems people need."

For instance, engineers must learn how a holographic pattern already stored in the crystal is affected by the process of storing another pattern. There are also obstacles concerning the retrieval of information in a high-fidelity, useable form.

Georgia Tech scientists are also concerned with the long-term stability of the crystals, and are studying samples that spent six years in orbit aboard NASA's Long Duration Exposure Facility.

Researchers at Bellcore, a consortium of Bell companies based in Livingston, N.J., have been working with lithium niobate and gallium arsenide crystals measuring one centimeter on a side. Theoretically, each crystal can hold 10 million holographic pages—that's roughly equivalent to a medium-size library of 200,000 novels.

The limits of holographic storage will probably never be fully realized, Glytsis notes, "but even if you could use only a fraction of that capacity, it would be an enormous gain not only for optical computing, but also for memory applications."

Holographic systems don't use any moving parts, and while serial computers retrieve data one bit at a time, the holographic technique processes in increments of an entire page or image. They can retrieve in one second what would take a magnetic disk drive five hours.

Holographic techniques can also be used to optically process the information they store.

"Various types of associative processing can be done holographically by finding matches between patterns you have received, and patterns that are stored," says Gaylord. "This can be used for identifying objects or signatures, or in data processing."

A Technology Link

The next step is the development of optical/electronic interfaces—devices that bridge today's serial computers with the faster parallel holographic data storage systems. Here, too, holography plays an important role.

"The holographic technique is more oriented to very high-speed applications, and applications where there is parallel data present," says Gaylord. "Holographically produced gratings are used to interconnect optical channels in communications or data processing structures."

Professors Carl Verber and John Uyemura of the School of Electrical Engineering are involved in the research effort.

LASER

"Electronics is serial—it does one thing at a time," Uyemura explains. By contrast, optical computing is parallel, processing many thousands of bits simultaneously. "But no matter how fast you can process something optically, you still have to get it into an electronic system so someone can use it."

Verber and Uyemura use holographic techniques to direct optical beams at light detectors and memory cells embedded on an electronic circuit, while downloading it with data from several optical signals.

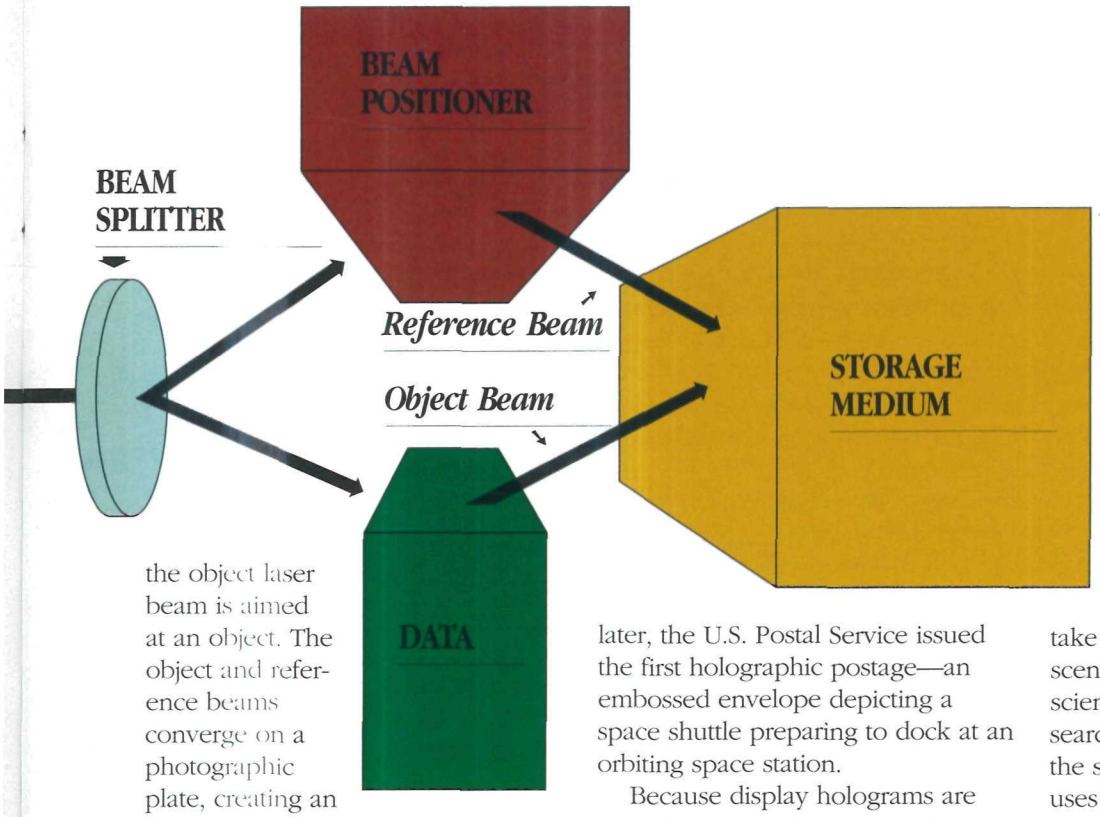
Uyemura believes that such a hybrid approach is the most practical technological direction, and that all-optical computing—if it is ever possible—would be far into the future.

"We can intercept the optical beam, process it electronically, and shoot it back out. This represents an intermediate step between electronic computing and optical computing. It's really characterizing the [optical] interconnects and what they mean."

Solid-State of the Art

The most familiar applications of holography are the three-dimensional images that have been popping up on everything from cereal boxes to trading cards.

The process for making display holograms is essentially the same as for storing data, except that instead of passing through an array of data,



the object laser beam is aimed at an object. The object and reference beams converge on a photographic plate, creating an interference pattern that contains all the information about the object in minute detail. After development, the plate or film is re-illuminated by approximating its angle to the reference beam. The developed interference pattern bends the light into a three-dimensional re-creation of the object.

Lenses are not used because they tend to distort the image, so holograms are the exact size of the object. And because the exposure time is several seconds, the object must be absolutely stationary. Holograms are shot on special tables weighing 3,000 pounds or more to eliminate vibration that would cause the image to blur. The process is so sensitive that living things cannot be shot because the slightest twitch—even the movement of a pulse—would disrupt the image.

Perhaps the best-remembered application of a hologram as a graphic device is the November 1985 cover of *National Geographic* showing a Taung child's skull. Four years later, the U.S. Postal Service issued the first holographic postage—an embossed envelope depicting a space shuttle preparing to dock at an orbiting space station.

Because display holograms are virtually impossible to forge, they are an extremely useful anti-counterfeiting measure. The most common examples are the holograms on credit cards, but they are also affixed to videotapes, General Motors' automobile parts, Super Bowl tickets and California drivers' licenses. Holograms may also be used on Olympic Village security badges during the 1996 Games in Atlanta.

In the rapidly growing field of fine-arts holography, artists are testing the limits of the medium as a graphics device.

Galleries such as Elusive Image at Underground Atlanta and the Museum of Holography in New York are dazzling visitors with a unique blend of art and technology.

The depth and detail of fine-art holograms can be breathtaking—and downright spooky. In fact, Elusive Image is working on holographic displays for a haunted house.

Many fine-art holograms are animated: a ballerina lifts her leg and twirls as you walk past; Shakespeare smiles and winks; the starship Enterprise fires its lasers. Others indulge in what might be called "interactive holography": looking through the eyepiece of a holographic microscope reveals an enlarged mosquito.

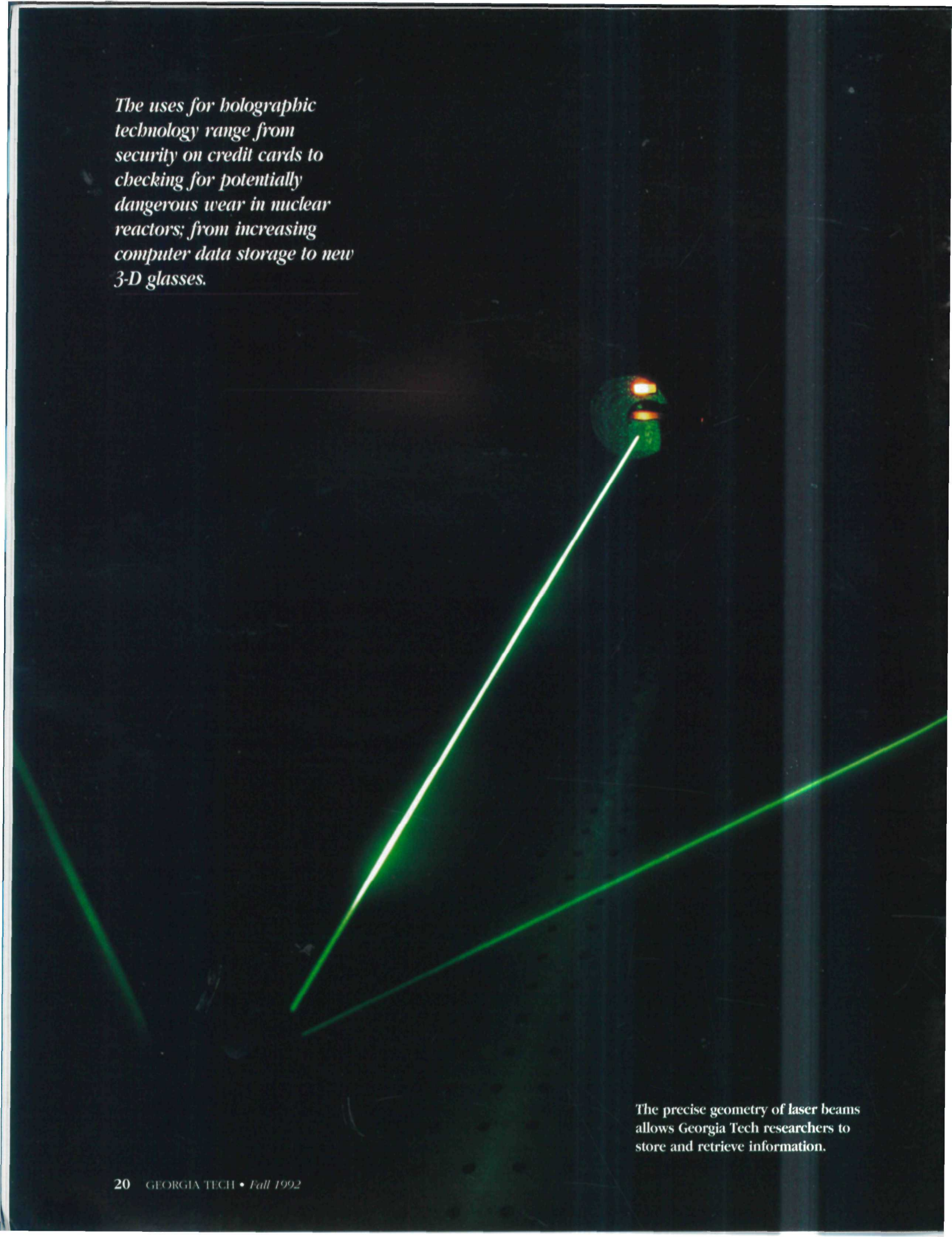
Another kind of hologram is found on F-16 fighter jets. Called a heads-up display, "it projects cockpit display information into the pilot's field of vision so he doesn't have to take his eyes away from the forward scene," says Nile Hartman, a senior scientist at the Georgia Tech Research Institute who helped devise the system. The heads-up display uses a holographic emulsion on a glass optic that is sandwiched between the layers of windshield glass. Holographic couplers transfer certain information from the vehicle's sensors to the optic. Hartman adds that the technology has also been adapted to automobiles for displaying speed, gauges and trouble lights. The F-16 display was designed using rigorous coupled-wave analysis, a procedure developed at Tech by Gaylord and his group.

Scientific Applications

Holograms are highly specific, like a fingerprint, to an object at a particular point in time, which makes the technology useful in commercial applications such as non-destruction testing. Holograms of structural elements, electronic components, nuclear fuel rods and a virtually limitless number of other items can reveal hidden manufacturing flaws or dangerous signs of wear.

Another common scientific use of holography is in making precise

The uses for holographic technology range from security on credit cards to checking for potentially dangerous wear in nuclear reactors; from increasing computer data storage to new 3-D glasses.



The precise geometry of laser beams allows Georgia Tech researchers to store and retrieve information.

gratings for scientific instrumentation —spectrometers are a good example. These instruments seperate light into wavelength components for spectral analysis, says Hartman. "The advantages of the holographic process are our ability to fabricate the gratings with specific diffraction characteristics, gratings of large surface area, and enhanced fabrication ease. "The old technique required the use of time-consuming ruling methods with limited capabilities for grating fabrication."

Holography is also useful in devising input couplers for optical wave guides—"a means of getting light into very thin optical wave guide films"—and an improved generation of chemical sensor elements.

Rick Steenblik is applying holography to an old-fashioned idea: 3-D glasses.

A 1980 mechanical engineering graduate, Steenblik has invented ChromaDepth, a technique in which different colors appear to be at varying distances from viewers who wear a pair of special glasses. The lenses are holographic film with interference gratings that shift the points at which different colors of light are focused. Thus blue objects appear to be behind red objects because the blue light is shifted farther than the red.

ChromaDepth lenses can create three-dimensional effects from any properly-colored two-dimensional image, regardless of whether the image is printed, broadcast or projected. Unlike most 3-D techniques, the images look good even if not viewed through the glasses.

The system could be useful in corporate presentations and entertainment, Steenblik says.

Treats with a View

One of the most unusual applications of holography has been developed by a Boston company that believes holograms should not only be seen—they should be tasted.

Dimensional Foods Corp. has patented a process for imprinting holograms on chocolate and hard candy. The technique forms tiny ridges directly onto the food surface without the addition of chemicals, dyes or other materials, according to company President Eric Begleiter. Because the ridges are so small—only about one or two nanometers in depth—the taste and texture of the product ("mouthfeel" in food industry parlance) is not affected.

The company hopes to license the process to candy manufacturers interested in making, for example,

Continued on page 24

Making Buzz Fly

Considering that Georgia Tech is one of the world's leading research universities, it is perhaps fitting that the *Georgia Tech Alumni Magazine* is, we believe, the first publication of its kind in the country to display a hologram on its cover.

The Buzz hologram was created from a combination of a 3-D model and two levels of flat art: a photograph of the Tech Tower and line art of a Georgia Tech logo pattern.

Buzz was sculpted by New York artist David Dann, one of a handful of artists who specialize in holographic models. His credits include the hologram on the November 1990 issue of *Omni*, and the Spiderman model for the 30th anniversary comic book hologram. Working from an original design by Mike Lester, Dann spent a week on the project.

Holographic modeling is a highly specialized field that combines artistic ability with knowledge of the laser-imaging process. To achieve the best resolution of detail, the Buzz model is slightly flattened front and back so it is only 3/8-inch deep, yet it is designed in such a way as to preserve its proportions. Holograms are produced on a 1:1 scale, so the model is the same size as the final image. Because laser light is monochromatic, the model is painted in a flat finish, with gray tones used for highlights and shadows.

Holograms referred to as H-1 exposures were made of each of the three levels of art with an Innova 400 blue-light krypton laser. An H-1 appears milky gray under normal conditions, and only laser light reveals the image that has been captured on the plate.

Next, the three H-1s are combined in a final exposure called H-2—a hologram of holograms. The H-2 is made of a photoresist material that is sensitive to blue light only, and records a hologram as a surface relief pattern.

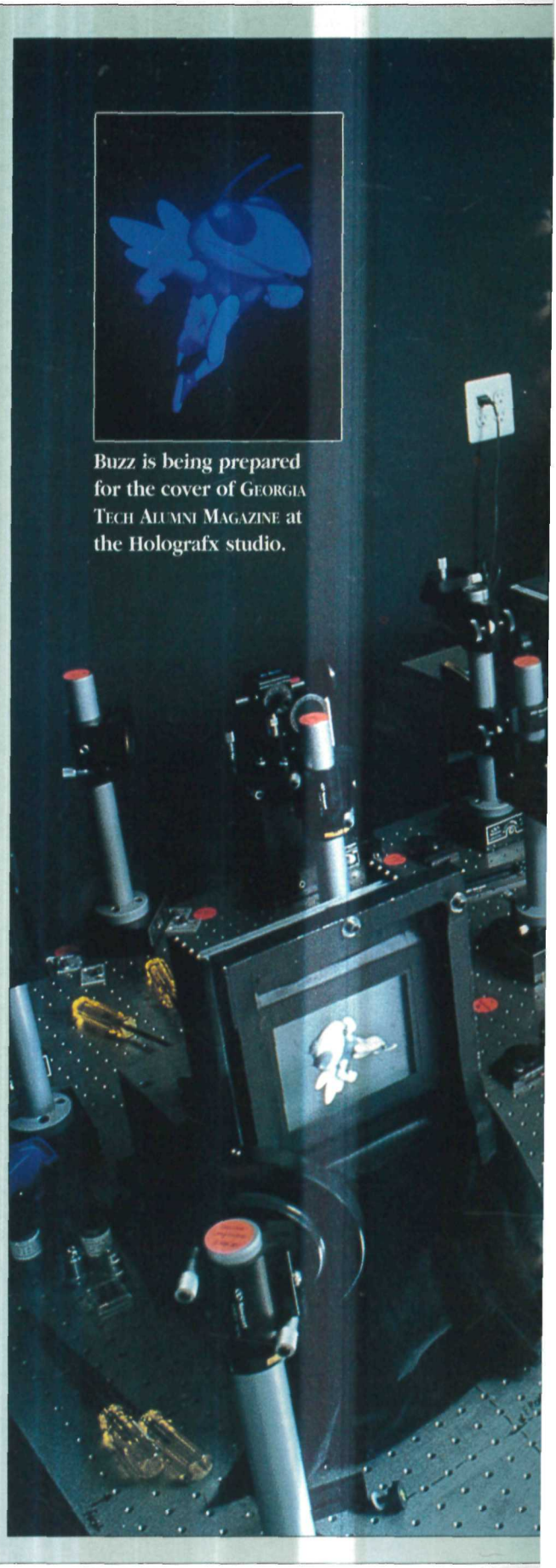
"An embossing plate is made by electrochemically depositing pure nickel on the photoresist H-2," explains Jeff St. Thomas, product manager for the Holographix Division of Crown Roll Leaf, the Paterson, N.J., company that produced the hologram.

This plate is copied through an electrodeposition process to make the actual embossing plates that will be used on press—ultra-thin replicas called shims, St. Thomas says.

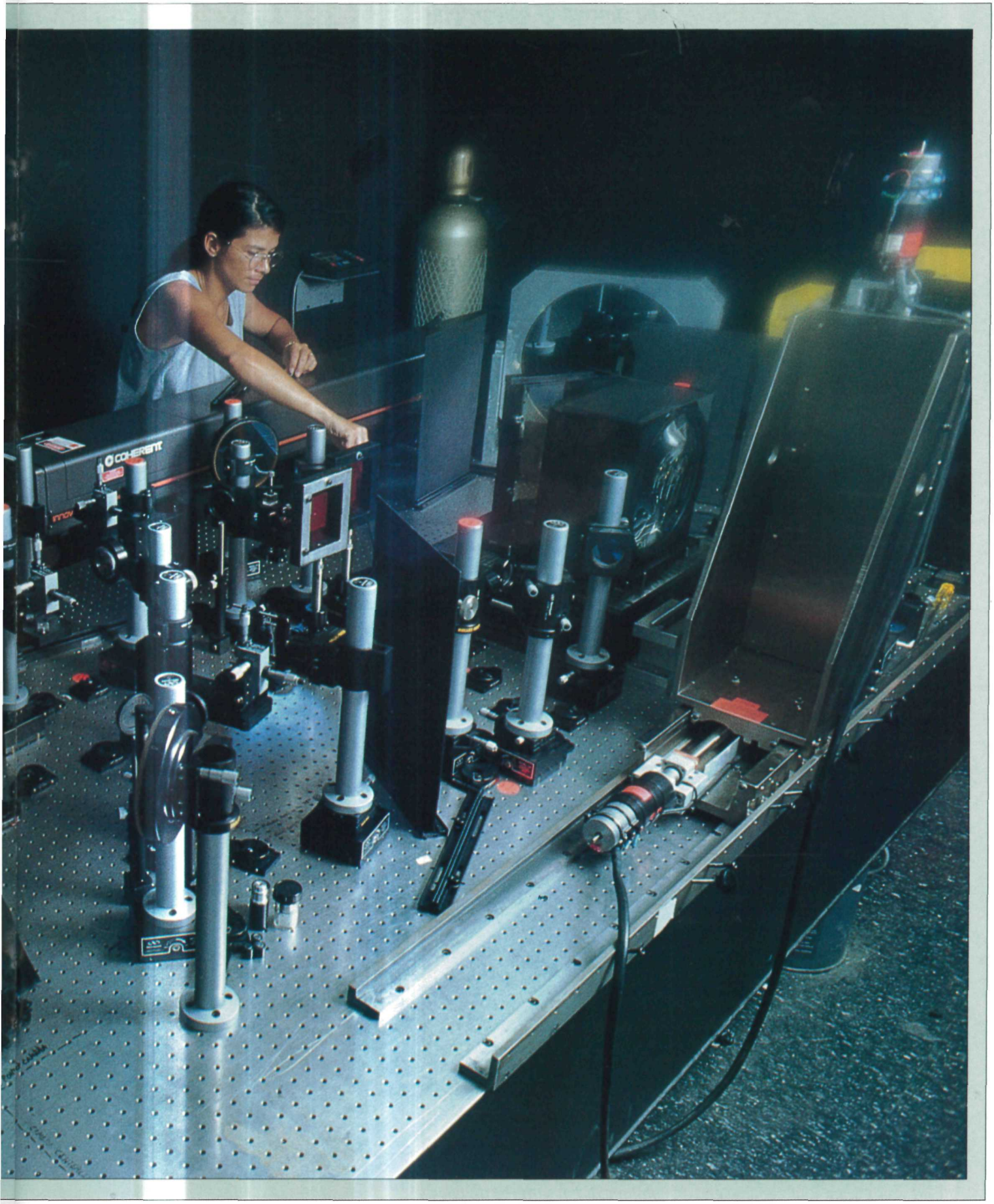
"Using a special rotary press, we emboss the hologram onto rolls of plastic film that have a special resin coating. The film is then metalized by depositing it with aluminum vapor under vacuum."

The final product is sized, cut and hot-stamped onto the cover.

The best way to view the Buzz hologram is under direct sunlight, or a clear incandescent bulb or halogen spotlight. The hologram will display a three-dimensional image when tilted from side to side, but not up and down. ■



Buzz is being prepared for the cover of GEORGIA TECH ALUMNI MAGAZINE at the Holografx studio.


COHERENT

The concept of holographic movies and television presents some extremely daunting engineering challenges. But when it comes to technology, you never say never.

chocolate bars that display a three-dimensional image of Santa Claus, or Valentine's Day hearts with "I Love You" rising above them.

Pharmaceutical companies, in an effort to crack down on the hundreds of millions of dollars lost each year to counterfeiters, have expressed interest in the technology for applying holographic logos to their pills and capsules, making them more difficult to copy.

Dimensional Foods is also experimenting with transmission holograms and has created a prototype lollipop that shows animated cartoons when it is twirled.

A 3-D Future

One of the most exciting—and technically challenging—potential applications of holography is in movies and television. "That's part of what multimedia is all about—the idea of creating presence in a way that extends the senses," says Fred Dyer, co-director of Georgia Tech's Multimedia Technology Laboratory.

A few attempts at producing holographic movies have been made. In the late '60s, a holographic movie of a goldfish swimming in a tank was made by recording a sequence of holograms on film. The movie, which lasted less than a minute, was illuminated by laser light, frame by frame. The main drawback: Only one viewer at a time could perceive the 3-D effect.

More recently, researchers at the Massachusetts Institute of Technology Media Lab demonstrated a computer-generated holographic sequence of the Star Trek starship *Enterprise* orbiting a planet. The image was a scant four centimeters long and the sequence lasted but a few seconds. Still, the effort shows that the holographic concept continues to attract investigators.

"One of the visions Nicholas Nicopante of the M.I.T. Media Lab has is the idea of sitting in your den and watching a football game being played right there on the floor with miniature players," Dyer says. "Now that's a *real* sense of presence."

Dyer recalls a recent demonstration by a vendor at the College of Computing when a special dual-lens display apparatus provided three-dimensional viewing of objects in a foot-square area. "You could sit two or three feet from the screen and have a sense of the object on the screen sitting right in front of you in space," he says. The device has several technical limitations, he adds, "but at least it's headed somewhere."

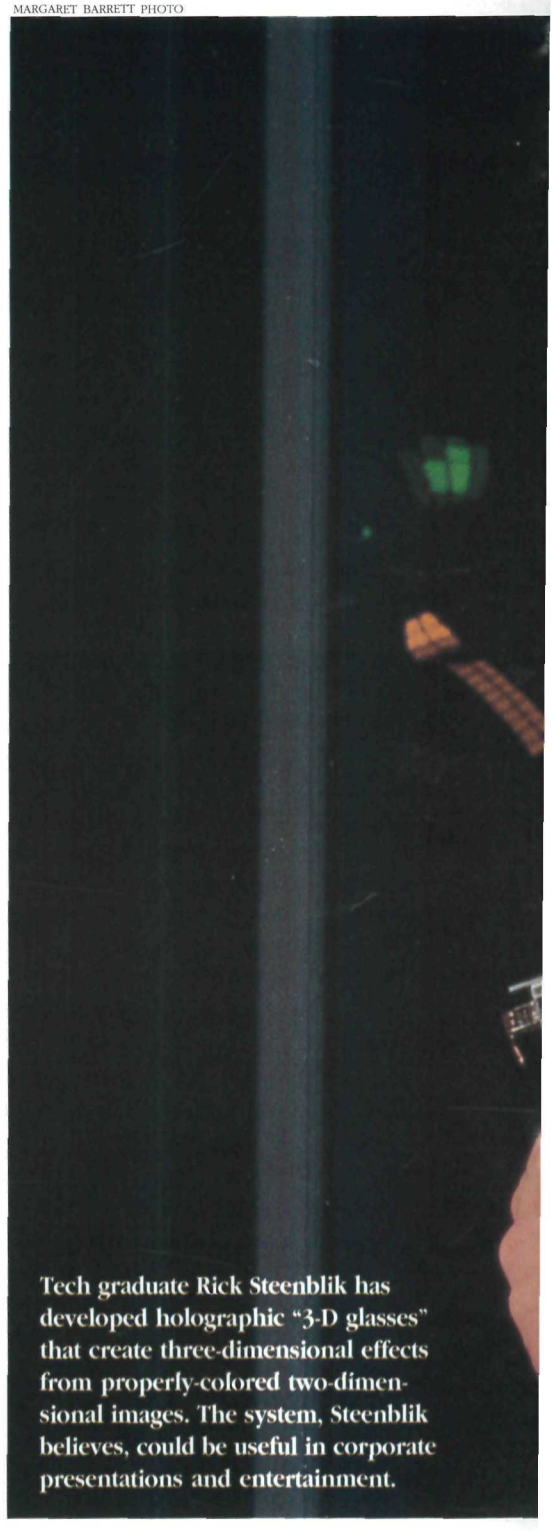
Dyer says that holographic projection systems—similar to computer-generated "virtual reality" but without the encumbrances of special goggles or gloves—could be a valuable education tool. Such systems may also help air traffic controllers, for example, see the true relative positions of planes in crowded flight patterns, or add another dimension to the view of organs physicians receive from tomography scans.

The whole thing sounds more than a little far-fetched, but Dyer cautions that when it comes to technology, "you *never* say never."

"In terms of what one might expect of the future, imagination is the only real limit." ■

See also "When Technologies Collide," describing advances in interactive multimedia, beginning on page 46.

MARGARET BARRETT PHOTO

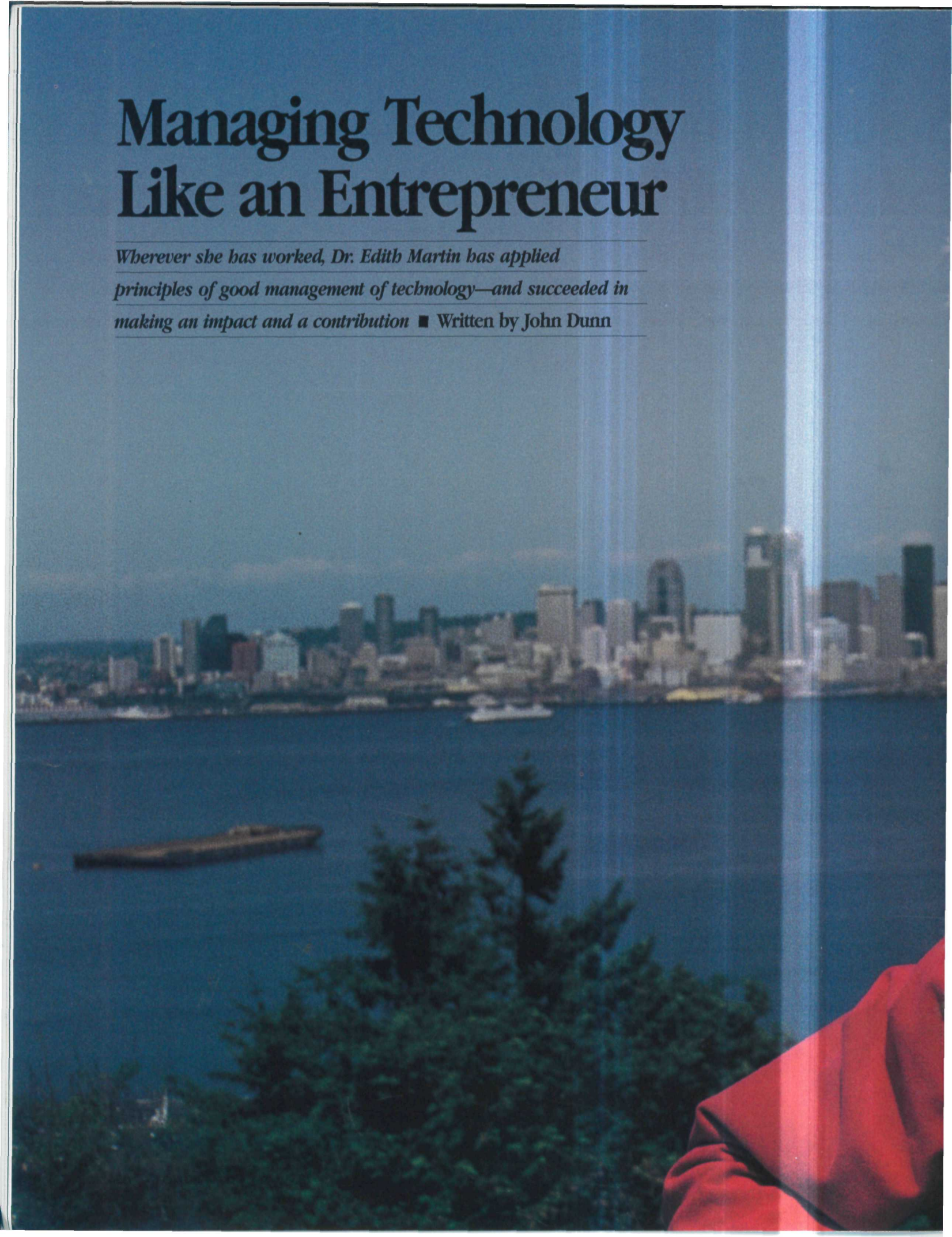


Tech graduate Rick Steenblik has developed holographic "3-D glasses" that create three-dimensional effects from properly-colored two-dimensional images. The system, Steenblik believes, could be useful in corporate presentations and entertainment.


3D

Managing Technology Like an Entrepreneur

Wherever she has worked, Dr. Edith Martin has applied principles of good management of technology—and succeeded in making an impact and a contribution ■ Written by John Dunn



"Some of the greatest leaders came about in times of adversity—either political or economic. Those who rise and become assertive in down times, as opposed to regressing, have stood out as phenomenal leaders."

These are not the times for timid managers or jittery retrenchment tactics, according to Dr. Edith W. Martin, a Georgia Tech graduate who is one of industry's no-nonsense managers of technology. These are the times, she says, for opportunity.

"I tend to be a lot more bullish than I see industry right now," Martin states.

On July 1, Martin, 47, became vice president and chief information officer of INTELSAT, a Washington, D.C.-based global communications satellite system owned by a commercial cooperative of 123 nations. For almost eight years, she was vice president of the Boeing Company's High Technology Center in Seattle.

"At a time like this, where rapid change is accompanied by rapid technological change and competitive change is confounded with difficult economic times, you get mixed reactions from industry," says Martin, who earned her master of science in 1976 and doctorate in 1980 at Georgia Tech, both in information and computer science.

"There are many segments of industry which are doing all these beautiful things they call 'retrenchment,' 'building down'—I love that one—'downsizing,' 'flattening,' and 'shrinking.' It sounds like everybody has been to Weight Watchers.

"That's all well and good if, in fact, you're taking out your inefficiencies and you are focusing in areas of strength—as long as you're doing that with a progressive attitude toward the future.

"Some of the greatest leaders came about in times of adversity—either political or economic. Those who rise and become assertive in down times, as opposed to regressing, have stood out as phenomenal leaders."

Business should demonstrate entrepreneurial leadership, she adds, but she fears the U.S. is "starting to lose major ground in the game of entrepreneurial dynamics.

"I think that the heads of big business have been entrepreneurs," Martin says. "I think they simply have become terribly status quo.

"Whether you start small and expand, or you start big and get bigger, the phenomenon is the same. There are just very few entrepreneurs heading up major corporations today."

Is she an entrepreneur?

"I think so, yes," she says. "I'm at least impatient. Impatience is an important part of being an entrepreneur. The complement of impatience is motivation. It's having a vision of what can be done, having a desire to realize that vision, and not being tied to how things occur traditionally—a willingness to break new ground. That's a willingness, not a need—just a willingness. But you don't do it just for its sake.

"If someone says to me, 'We've never done that,' I say, 'Is it illegal?' If they say, 'No, it's not illegal,' then I say, 'Don't give me the rules.' "

A former member of Georgia Tech's Advisory Board, Martin returned to the Georgia Tech campus last May as a "visiting professor," speaking to electrical engineering classes on managing technology, a presentation excerpted from an address she made at the 1992 International Strategic Management Conference in New Orleans.

It is her routine to rise at 5 a.m., fix a cup of coffee, and relax in a rocking chair, mentally preparing for the day ahead.

"That's my quiet time," says Martin, "my think time.

"It's a very important part of my day. That's when I come up with counter-point types of views. Am I accepting things at face value, or have I really made an effort to understand what can be done? Do I accept the limits people say are there, or do I re-examine just to make sure I believe it?

"You don't get think time on prime time," she adds. "My definition of prime time is the minute I put my foot in the office. The phone starts ringing and the meetings start and I can never reclaim the day."

A graduate of Lake Forest College in Illinois, she came to Tech as the 22-year-old wife of Dr. Charles S. Martin, a member of the civil engineering faculty. At 26, she was a vice president at Massey Junior College, and shortly afterwards she became an owner of a computer company in Atlanta. "I did that for several years," Martin says, but adds that she realized, "I want to be more than technically competent. I want to be more than an executive. I really want to be a leader. If I want to be a

leader, I need to do something that gives me a depth of capability that qualifies me to do something that causes change. With that, I made the commitment." Martin sold her portion of the company and began work on her graduate degrees at Tech.

As a graduate student, Martin became a faculty member in the School of Information and Computer Sciences. She was a founder and from 1976 to 1980 was director of the Computer Science and Technology Laboratory at the Georgia Tech Research Institute.

Polly Hampton, now an administrative coordinator in the External Affairs office, was Martin's senior secretary at the lab. "Edie's a very intelligent person—a very lovely and gracious person," Hampton says. "At the same time, she can be hard and demanding. She never asked more of her employees than she asked of herself. Some people found her hard to work for—she wants things done right."

Hampton adds that Martin demands both the best from her employees and the best for them. "She looked after her people. She tried to see that they made the highest salaries and had the best benefits that were available. She liked to see people rewarded for their accomplishments, and she gave credit where credit was due. She's a first-class lady."

In 1980, Control Data Corp. of Minneapolis named Martin executive director of its newly established, Atlanta-based Government Systems Division. She was responsible for the initiation and direction of advanced technology planning and re

"The complement of impatience is motivation. It's having a vision of what can be done, having a desire to realize that vision, and not being tied to how things occur traditionally."

Martin on Management

During her career as a manager of technology at the Georgia Tech Research Institute, the U.S. Department of Defense, the Boeing Co. and INTELSAT, Edith Martin has compiled a list of "management observations."

Cooperation

- No matter what your position, the organization is always stronger than the individual.

Conflict

- Someone has to be the first to smile.

Conviction

- When others support you, be glad, but always be prepared to stand on your own.

Change

- Change rarely comes overnight. It's rarely close to 100 percent. It's rarely without fluctuation.

Mistakes

- Making and recovering from mistakes is what experience is all about. When you make a mistake, admit it immediately, propose a solution promptly, and participate in the correction.
- Even a bad job is a good experience. It helps you calibrate situations, and helps you recognize a good job, a bad job and progress.

Attitude

- Have a healthy attitude.
- A bad attitude is never rewarded, seldom justified, rarely appreciated and usually destructive.

Setbacks

- I have never had a setback that has not ultimately benefited me.
- Setbacks have made me address a problem, made me stronger, or made me more committed.

Prejudice

- If you look for prejudice, you'll find it.

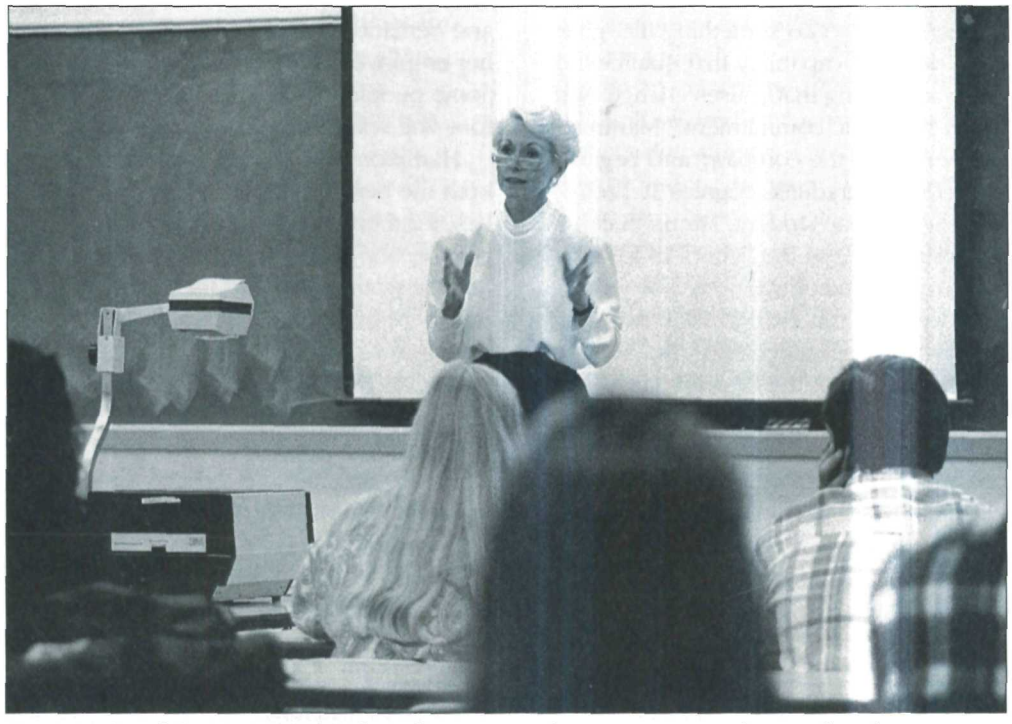
Progress

- Accept progress in any form.

You Can Learn Something from Everyone

- Everyone you have known has influenced your life. We are who we are because of others.

"I enter everything I do with a lot of belief, a sense of importance about it, and a commitment that if I don't have all the skills I need, I'll acquire them. . . ."



Dr. Martin visits Georgia Tech to lecture students on managing technology.

search. The operation was financially successful and received the company's Technical Excellence Award during its first year.

Two years later, Martin received a presidential appointment as deputy undersecretary of defense for research and advanced technology in the U.S. Department of Defense. She managed all basic research, exploratory development and non-systems-oriented advanced development in the DoD Science and Technology Program, managing a $5-billion budget, 20,000 projects, 60,000 employees and 73 laboratories. She expanded the Very-High-Speed Integrated-Circuits Program, intended to enhance U.S. competitiveness in the semiconductor industry, and founded the Software Engineering Institute.

Martin joined Boeing in 1984 as the highest-ranked woman in the $25-billion aircraft maker and defense contractor. In 1985, she undertook the establishment and direction of the Boeing Electronics High Technology Center, serving all Boeing divisions in areas relating to advanced research and technology. She also was an advisor to Boeing's executive management on national and international research and development policy, as well as defense and space technology trends and applications.

Martin is a fellow in the Institute of Electrical and Electronic Engineers, a member of Sigma Xi honorary scientific research society, and was the first Susan B. Anthony Award recipient for leadership in industry. She has published more than 150 professional and technical articles, and earned such accolades as one of the 100 Top Corporate Women by *Business Month* magazine, and one of the 20 most powerful women in corporate America by *Savvy* magazine. She was a 1991 cover story feature in *Executive Female* magazine. She serves on approximately 20 boards and after her business day often attends civic functions. In Seattle, she was a patron of both the philharmonic orchestra and the opera, a trustee of the ballet, and a regent of the art museum.

As vice president and chief information officer at INTELSAT, Martin fills one of four vice presidential posts directly under INTELSAT's director general/chief executive officer. Martin's responsibilities include computer and electronic data processing services for the international commercial cooperative nations that own the communications satellite system. INTELSAT is the major provider of transoceanic telephone and television services, and also offers via its 19-satellite global system such services as international video, teleconferencing, facsimile, data and telex.

Now divorced, she is the mother of a

Continued on page 32

Dancing with the Right Partner

Edith Martin knows a couple of technology horror stories. In one, which she calls technology erosion, a leading company in a technological field such as semiconductors invests research funds and directs its "key hotshots" to develop its next generation product. Halfway to completion, the hotshots leave, obtain venture capital funds, and start their own company. It takes two years for the original company to recover and initiate development of yet another new product. It takes two years for the start-up company formed by the break-away hotshots to build and develop their product, and start on a new product idea. At this point, the whiz kids of the two established companies break away to form their own companies, going into a building mode while the two established firms go into a recovery mode.

"As a result of this erosion phenomenon, advanced technology develops, but products never get to the product line, never to the profit line," Martin states.

"In contrast, the Japanese compete aggressively in a multi-pronged fashion during the early stages of market development. As strengths evolve and market-niche penetration gains clarity, consolidation occurs. These consolidations lock up a wide market span, and at the same time move positively in the direction of technology and progress.

"We've legislated our way to some extent into this box with our anti-trust regulations," she says. "To protect themselves, industry has come up with bureaucratic solutions to what I would consider entrepreneurial problems.

"Why are these people spinning out?" she asks. "Because they see an opportunity to participate more fully in the rewards of their performance." Industry, she says, should reward entrepreneurs for the benefits they contribute and "ditch some of that out-of-date bureaucracy which may be self-defeating."

The Department of Defense's Very-High-Speed Integrated-Circuits Program and the Microwave Monolithic Integrated Circuits Program provide the basis for another horror story—one that Martin fears will be repeated in the Department of Commerce high-definition television initiative.

"The nation has a technology lead. Because of the erosion phenomenon the nation loses it. The nation wants it back. The nation's defense has a need. It's expensive to satisfy. Defense funds more contractors to develop the technology needed to satisfy the market. Other contractors develop the technology with private funds in order not to be left out of later competition. Everyone succeeds—a lot of money is spent. The need is met, the market is saturated.

"Suppliers have dormant expensive capital assets, have vested too much future on too little opportunity, and have left themselves vulnerable to displacement by other emerging technologies," she states.

It may be a case of "damned if you do, damned if you don't," she admits, but adds, "It's cheaper to *don't*."

The solution, she believes, is to create strategic business alliances. As vice president for the Boeing Co.'s High Technology Center, one of Martin's areas of expertise was "strategic technology partnering."

During her years with Boeing, Martin helped forge multimillion-dollar strategic alliances with *Fortune* 500 and international start-up companies that gave Boeing a "cost avoidance" of more than a half-billion dollars.

"One of the skills companies have to relearn, rethink and revise to meet the challenge of the future is how to make business arrangements to acquire technology," Martin says. "A firm's survival may very well and probably will hinge on the effectiveness of the agreements it can forge with other companies."

One of Martin's first projects at Boeing involved semiconductors. The aerospace firm did not manufacture computer chips, but its growing need for semiconductors engendered a desire for a competitive edge. An option was to obtain semiconductor manufacturing capability, an area in which Boeing was unfamiliar. Martin figured out the cost of making chips, detailing expenses and the potential for return. After Martin's calculations, Boeing readily decided in favor of a joint venture with another firm.

Martin warns, however, that seven of 10 agreements do not meet expectations, and only one of three partnership ventures succeeds in the long run.

Any company contemplating an alliance should understand its own corporate strategic goals and what it expects from an alliance, and should have an understanding of the national and international business climate, she says. And, she adds, a company should understand why its partner wants it to succeed, and why it wants its partner to succeed. Without a mutual desire for success, she warns, don't make an agreement. ■

son, William, born in 1971, and a daughter, Christine, born in 1979. She is a dilettante architect who enjoys renovating houses; among them she renovated an old slave house in Atlanta that had become a tenant house.

To unwind, she has found outlets in hiking, tennis, and golf. But she seldom mixes recreation and business. "If I go out to play golf, I go out just to enjoy it."

Although she does not seek to be a role model for women, she concedes that she may be viewed as such. What would she like for other women to see?

"I'd probably like them to think I'm somebody I'm not," she laughs.

"I would like them to see somebody who has had a very satisfying career as a result of several things," she continues. "I have focused on doing things that I thoroughly enjoy. And it is important to me to have an impact and make a contribution. If I know I'm going to enjoy it, that I'm going to have an impact and make a contribution, then I know I can put my energy into it. By virtue of succeeding on impact and contribution, other things kind of fall your way. They were never the target.

"I just enter everything I do with a lot of belief, a sense of importance about it, and a commitment such that if I don't have all of the skills that I need, I'll acquire them and put in the necessary work to make it happen." ■

"By virtue of succeeding on impact and contribution, other things kind of fall your way. They were never the target."

The Right Technology

How does a company determine which technologies it should pursue to realize the greatest benefit? "The process of deciding what to do with respect to either technology acquisition or research and development has been more intuition and art than pragmatic," observes Dr. Edith Martin, who devised a system to help the Boeing Co. target its technologies.

As vice president of the High Technology Center, Martin developed a research and development criteria to evaluate which technologies would make a significant competitive difference to Boeing. Her selection criteria became known as the "Martin Filter." "We knew the technologies we wanted to pursue; we needed to narrow that down to the projects within the technology that would have the most dramatic impact," Martin explains.

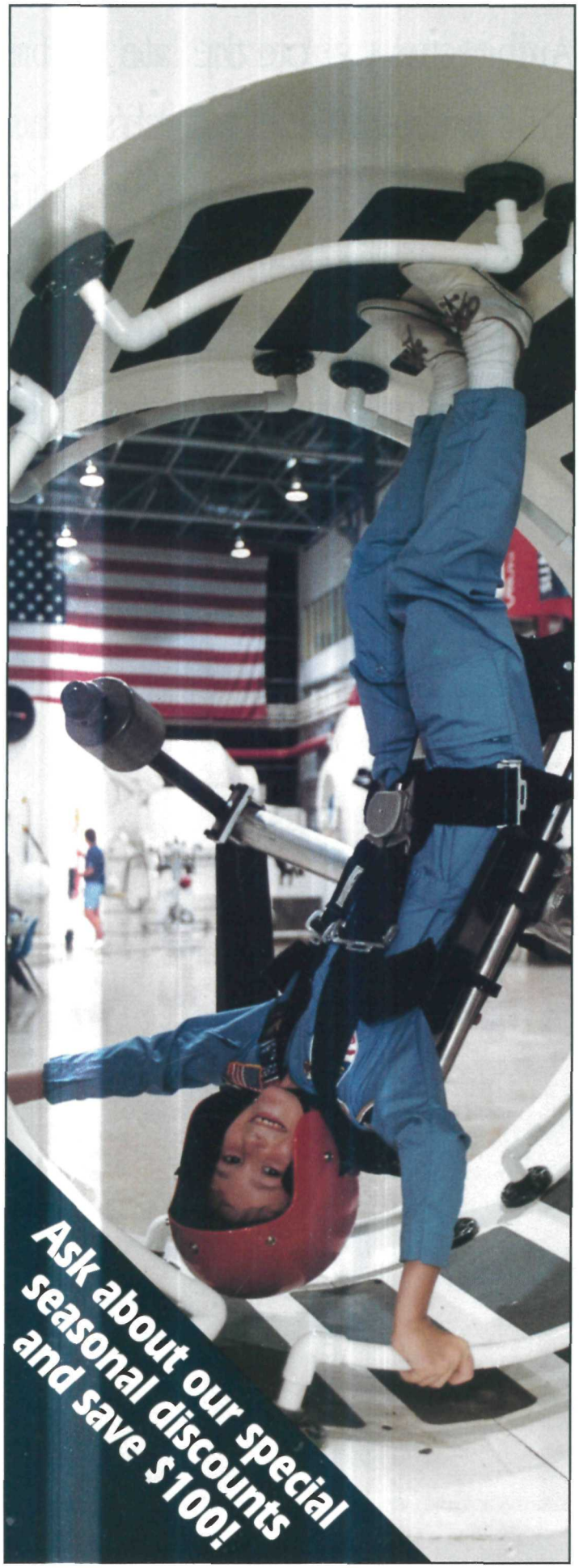
The catch is that nothing filters through, says Martin, whose system views project selection through the eyes of research, engineering, manufacturing, marketing, finance and the share holder.

"The importance is to be pragmatic in your decision-making at the earliest stages," she states. "Be pragmatic and look at all of these aspects simultaneously because a quick scan may reveal some fatal flaw or that it is premature. The motivation was to put myself and our organization in a position where it could speak in terms of its customers."

Projects were reviewed in terms of end-product leverage, market leverage, potential for proprietary content, cost of entry, suitability to prototyping, ability to demonstrate meaningful results within 3-5 years, and widespread applicability, while also giving consideration to in-house manufacturing potential, in-process investment decision points, potential for vertical technology integration, and independence of other breakthroughs.

Martin says the approach to determine which technology was best for Boeing to pursue was refined, and ongoing project performance evaluation evolved into a set of key factors:

- Goals/objectives
- Technical approach
- Technical progress
- Discriminating technology
- Competitive position
- Impact to other High Technology Center projects
- Impact to company
- Technical transfer plan
- Project budget
- Personnel
- Facilities
- Outside funding opportunities



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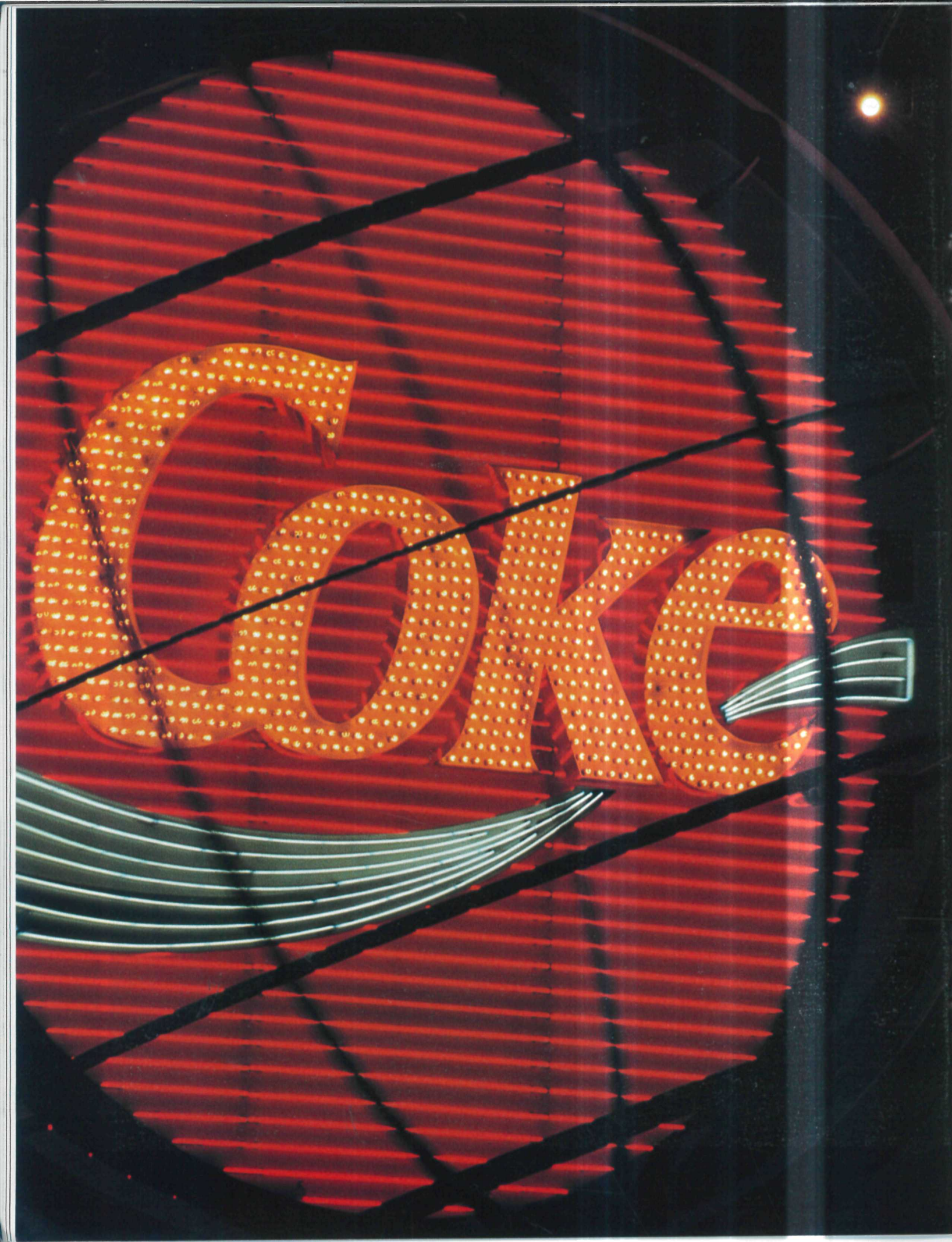

Coke

Coca-Cola Pavilion, 1990

Thompson Ventulett & Stainback

Bo Crum, ARCH '66; Nancy Cartledge, ARCH '83, MS '86

The pavilion was conceived by the architect as not merely a commercial advertisement, but as a serious work of architecture. It responds in meaningful ways to contextual and urban-design issues. The manipulation of scale, texture and imagery is deliberate—to convey permanence without being overbearing; to make people smile without being overtly humorous; to project civic scale without sacrificing intimacy; and to be contemporary without being trendy.

—Bo Crum
Partner-in-Charge

Hulse Residence, 1985

Anthony Ames Architect

Anthony Ames, ARCH '68

The Hulse residence was designed for a young Atlanta couple who was interested in a modern interpretation of residential living in Ansley Park. The large house which originally occupied the site was demolished, and the new residence was placed perpendicular to the street and to one side of the lot, allowing for a garden accessible from the main living areas of the house. The double-height living room and the master bedroom are visible on the front facade, and provide the owners with views of the park across the street. The crisp geometric forms and monochromatic treatment contrast with and emphasize the lush natural surroundings.

—Anthony Ames

Lakewood/Fort McPherson MARTA Station, 1984

Reynolds Architects

M. Garland Reynolds, FAIA, BS '59, ARCH '60

This suburban rapid rail/bus station was designed with open steel trusses to recall the late 1800s train-shed era. Because Fort McPherson Army base is located next door, the station was decorated in red, white and blue for a Fourth of July celebration spirit.

—Garland Reynolds

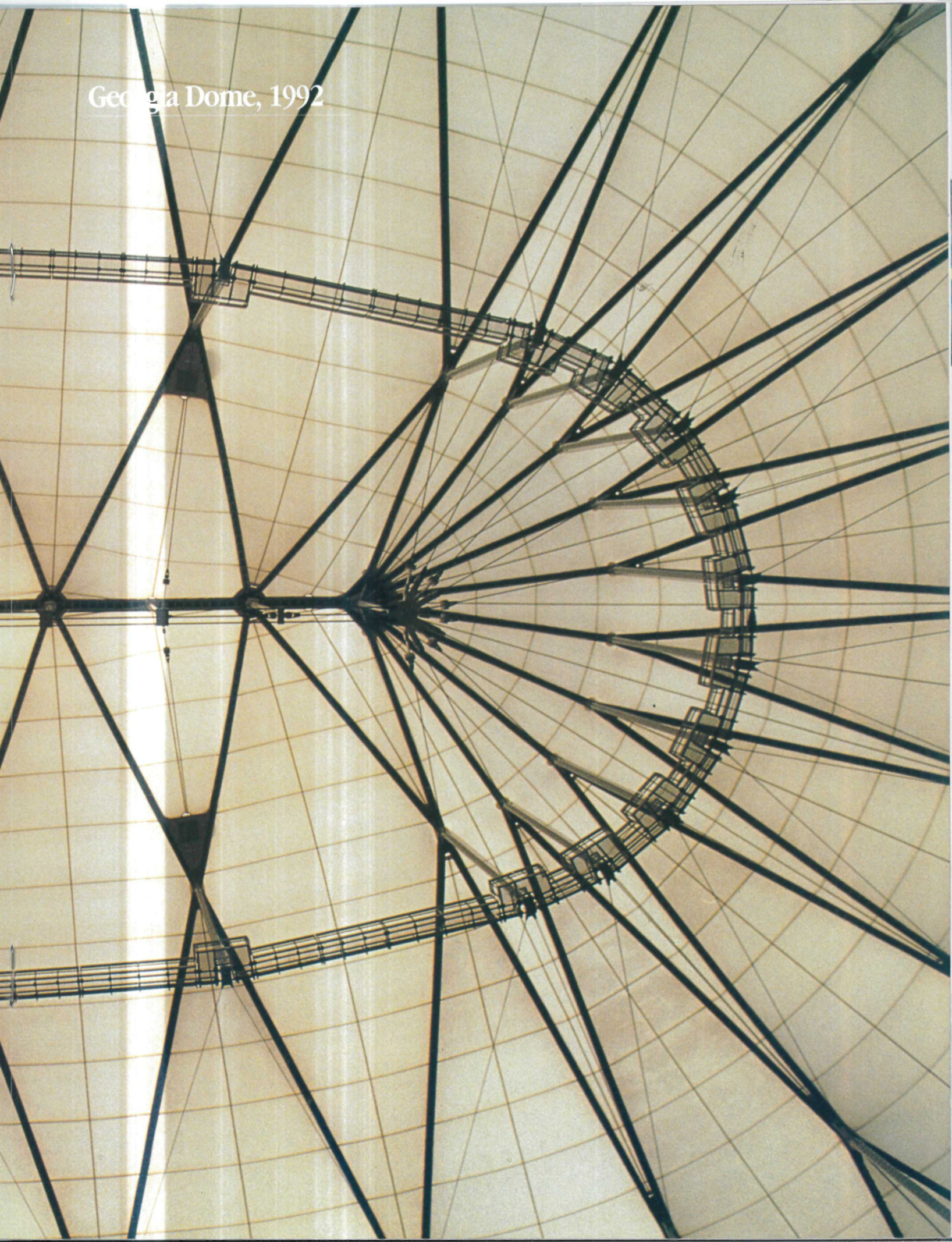
Georgian Terrace Hotel Renovation and Addition, 1991

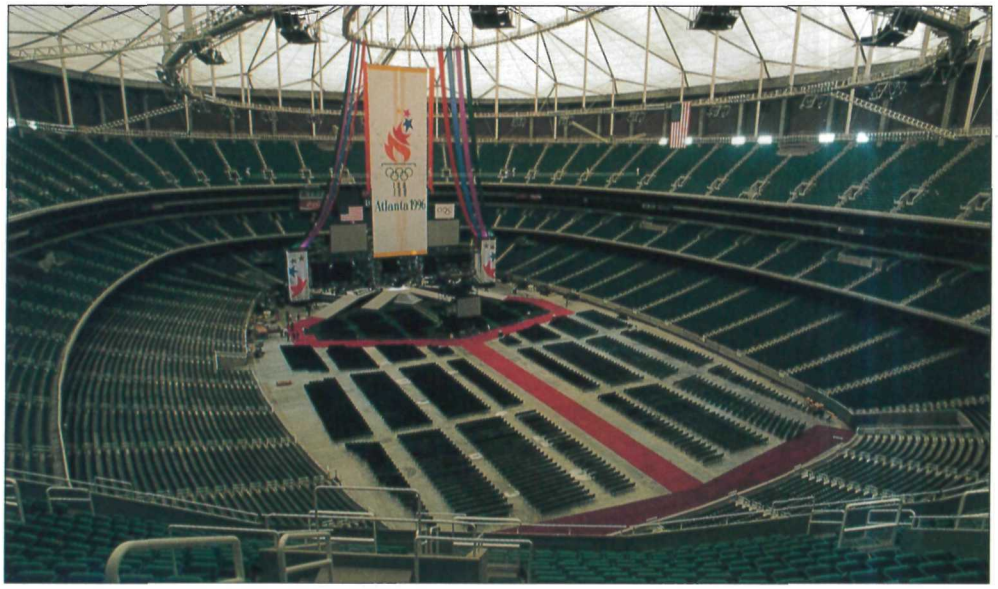
Smallwood Reynolds Stewart Stewart & Associates

Phil Smallwood, ARCH '62; **Howard Stewart,** AIA, ARCH '69; **Chuck Hull,** ARCH '79, MS '82; **Tom Ferguson,** ARCH '79; **Kevin Wyatt,** ARCH '85, MS '88; **Dave McCauley,** MS ARCH '88

The challenge was to blend the new and old structures into a composition that complemented the original historic building. To accomplish this and maintain the integrity of the old hotel, we designed the new addition with similar materials, scale and organization to the existing building. A new atrium, constructed of steel and glass in the spirit of a turn-of-the-century conservatory structure, connects the two buildings.

—Howard Stewart
Design Principal


Georgia Dome, 1992



Georgia Dome, 1992

Rosser Fabrap International/Thompson Ventulett & Stainback/Heery International

Henry H. Teague, BS '58, ARCH '59, MS ARCH '60; **W. Ennis Parker Jr., AIA,** ARCH '65; **George D. Bushey, AIA,** BS '80, MS ARCH '83; **Marvin C. Houseworth,** FAIA, ARCH '63; **James E. Curry IV,** FAIA, BS '85, ARCH '87; **David E. Marshall,** EE '81

Thomas W. Ventulett III, FAIA, BS '57, ARCH '58; **Jeannye Dudley,** BS '88; **Bill Garcia,** ARCH '85, MS 85; **David Hubbard,** BS '84, ARCH '87

Our desire was to make a building, not a stadium, with finishes and amenities appropriate for convention and entertainment environments.

—W. Ennis Parker Jr.

The use of a cable-supported translucent roof creates an interior space that is light and airy while also creating a signature element for the building's exterior. The circus-tent-like character of the roof along with the use of color provide the dome with a festive and electric atmosphere appropriate to its high-energy use.

—Thomas W. Ventulett III

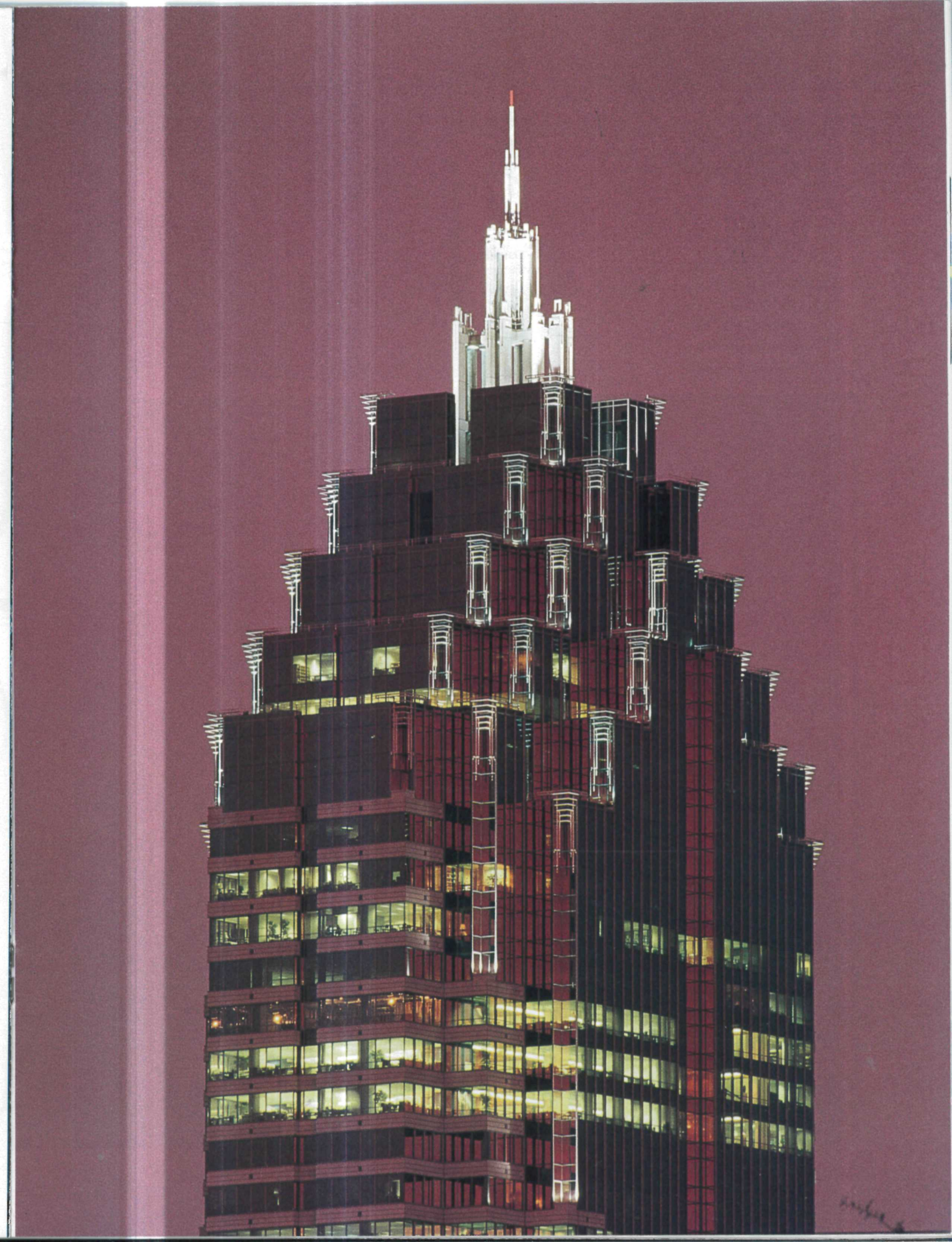
Promenade Two, 1990

Thompson Ventulett & Stainback

Ray C. Hoover III, ARCH '72; **Dale McClain,** ARCH '80, MS '82; **Karen Choate,** ARCH '82, MS '85; **Nancy Cartledge,** ARCH '83, MS '86; **Rafa Garcia,** ARCH '76

Sited within a landscaped garden, the structure is intended to become a noted landmark of corporate elegance with its architectonic form inspired by the rich tradition and spirit of the skyscrapers of the 1920s and '30s. With its unique profile of ornamented stepped roof terraces, culminating in an illuminated soaring spire, the building's silhouette presents a memorable image of the Atlanta skyline.

—Ray C. Hoover III
Partner-in-Charge



Carter Presidential Center, 1986

Jova/Daniels/Busby

Stanley L. Daniels, FAIA, BS '60, ARCH '60; **Stephen Withers,** AIA, ARCH '67

Our objective was to create a series of buildings that portray a period of history, and a person. We sought a tone of dignity and stateliness that would be inviting and friendly.

There is a sense of permanence about the complex—a sense that offers a lasting glimpse of American history.

—Stanley Daniels

BILLY HOWARD PHOTOS

Dobbs University Center at Emory University, 1986

Portman & Associates

John C. Portman Jr., BS '50

Design of the Dobbs University Center at Emory presented a unique opportunity to combine the facade of a significant existing building within the new structure, thereby creating a focal space that becomes the campus living room where students meet, study, dine and entertain.

—John C. Portman Jr.

When Technologies Collide

Multimedia Magic

Written by Don Hudson and Gary Goettling

Comedian Elayne Boosler, talking about her life-long investment in record albums, says that she refuses to buy a compact-disc player until she can get written assurances that something better won't replace it in a few years.

Forget it, Elayne.

Innovations in consumer electronics and computers are on a collision course. The impact will further a new hybrid technology called interactive multimedia, which will profoundly change the way we interact with our environments at work, at home, and with each other. Moreover, Georgia Tech and Atlanta are well-situated for unprecedented leadership in this area.

What is multimedia? Basically, it is the computerized integration of words, sound, graphics and video. What's significant is that these electronic media are now compatible, using a computer's digitized architecture as their common language.

Multimedia technology will provide users with more information, and more ways to manipulate information. Home movies could be produced with Hollywood-quality sound tracks, or digitized for special animation effects. Business conferences may be networked world-wide. Training videos with the sophistication of aircraft simulators will be available for home use. Elaborate scholastic presentations will raise the level of classroom standards.

With three major industries—computing, consumer electronics and telecommunications—in an all-out sprint for leadership in the field of multimedia, advancements are speeding along at a exponential rate.

■ Kodak recently announced the option of having photographs digitized and scanned onto a compact disc, where they can be displayed on a TV using a special CD-ROM player. By connecting the player to a PC, the photos can also be viewed on the computer screen and manipulated, printed or transmitted—in essence creating an electronic darkroom. Logitech goes a step further with its Fotoman digital camera, which takes pictures that can be downloaded directly to a Macintosh, without film or developing.

■ The California Department of Motor Vehicles is experimenting with interactive video terminals that would allow drivers to take tests and renew their drivers' licenses electronically. The concept could be utilized by other state agencies to handle other routine functions such as welfare applications, parking tickets and fishing licenses.

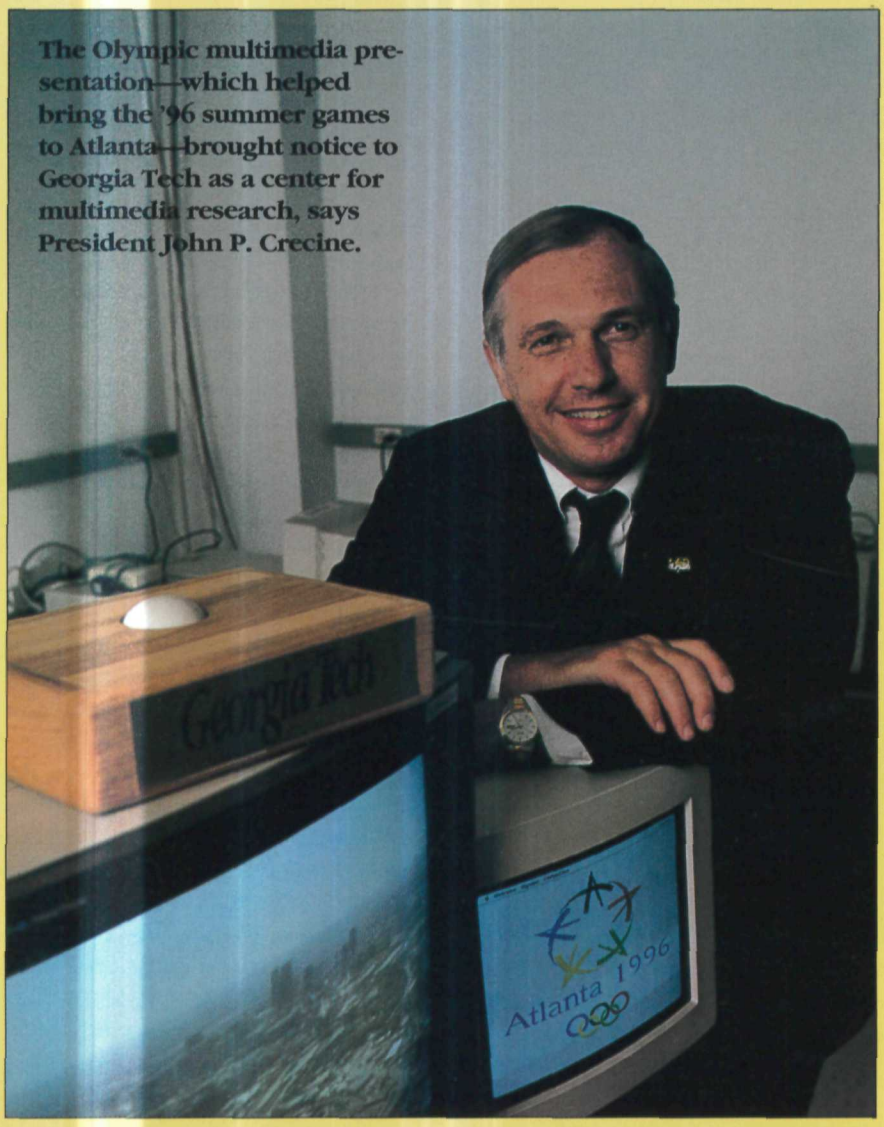
■ IBM and Time Warner are considering a joint venture that would unite Time Warner's vast video tape collection of movies and TV programs with IBM's interactive video technology to provide programs for home viewers.

One of multimedia's most successful applications to date has been Atlanta's presentation video to the International Olympic Committee, which was developed by Georgia Tech's Multimedia Laboratory. The 3-D presentation shows a futuristic view of Atlanta in 1996, with digitized graphic models of non-existing facilities overlaid on their proposed sites. Perhaps more than anything else, this multimedia presentation convinced the IOC that Atlanta was a major player in the bidding, and established the city's high-tech theme for the centennial Games.

"We have done some things here which we would not have done without a rich applied problem like this," Tech President John P. Crecine says of the Olympic project and its impact. "There has never been anything like this in the South before. Very few cities have a chance to reshape their image. We have a chance to remake the image of Atlanta and the South. In some areas of the world, Atlanta has a good image. In other areas, it is still tied to an antiquated past."

Crecine's new image puts Georgia Tech and Atlanta at the center of a multimedia industry that integrates various communications technologies via a vast digital network carrying everything from high-definition television signals to telephone conversations to computer data.

"I think the multimedia business can be done better here than at any other place in the country," says Ben J. Dyer, IE '70. Dyer is president and



The Olympic multimedia presentation—which helped bring the '96 summer games to Atlanta—brought notice to Georgia Tech as a center for multimedia research, says President John P. Crecine.

MARGARET BARRETT PHOTO

owner of Intelemedia Sports, a multimedia shop located at the Advanced Technology Development Center on the Tech campus. Intelemedia has worked with Tech football coach Bill Lewis to develop a line of products aimed at high school and junior high coaches and that teach the decision-making and mental aspects of team sports such as football, baseball, basketball and soccer.

"There's a large cadre of skilled and talented people in the Atlanta market who would be great resources for multimedia companies," Dyer says. Cox Enterprises and Southern Bell are on the roster of major corporate players, which also includes dozens of multimedia development firms such as Comsell, which Dyer founded. The excellent technology base of Georgia Tech anchors Atlanta's emerging multimedia industry, he adds.

But Tech is not the only force behind Atlanta's high-tech transformation. Turner Broadcasting and Cable News Network have made Atlanta an important media center; AT&T's largest fiber-optic manufacturing plant is located in the metro area; and Scientific-Atlanta has established itself as a leader in long-distance transmission of signals via satellite. In addition, IBM's multimedia operations are headquartered in Atlanta, spawning major action in local business.

Michelle Francis, Mgt '88, develops multimedia applications for IBM. She sees Atlanta's prominence in the technology mirrored in the growth of her office. "It all started here—all of IBM's computer-based training/marketing was done out of Atlanta. The multimedia division is an outgrowth of that," she says. "Over the past two years, the multimedia group has gone from about 35 people to 150. We're plenty busy just with people coming to *us*."

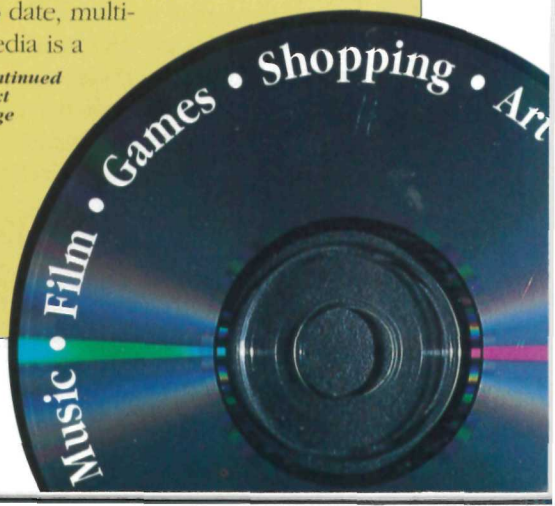
"IBM is bringing the global market here," says Comsell's Steve Roden. "Basically, Tech has received a lot of exposure for the Olympics. But IBM's presence here has made Atlanta the central stop for foreign business. A lot of people come to do business with IBM, and they can visit the other people here."

Ironically, IBM's well-documented financial woes have been a boon for Atlanta.

When IBM introduced the PC 11 years ago, Big Blue farmed out microchip manufacturing to Intel and software rights to Microsoft. IBM clones sprung up everywhere, powered by Intel components and driven by Microsoft software. By vastly underestimating the PC and its effect on the mainframe/minicomputer market, IBM watched its virtual monopoly disappear. Now, multimedia and systems integration is the primary vehicle IBM is betting on to compete with Microsoft and, to a greater degree, Japan.

To date, multimedia is a

Continued next page



technology where the United States has a pronounced advantage over Japan.

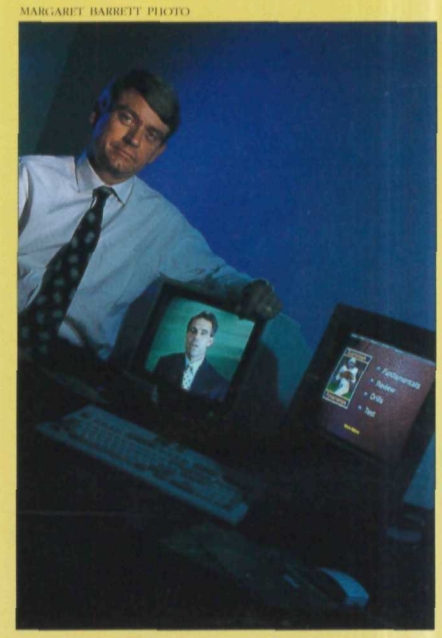
In multimedia, "IBM saw a technology that the Japanese could not copy easily," says Roden. "The Japanese have tremendous copying talent, but they don't create or integrate technology as well. They do not have the creative ability of our culture. They have never been able to equal our movie industry because they do not have America's creative talent."

Indeed, specialization puts the Japanese at a distinct disadvantage in some creative ventures. While they are known for perfecting our inventions and technology, from autos to computers, they are not known for innovative design. That leaves the U.S. dominant in multimedia development.

Atlanta in particular also benefits from a tradition of entrepreneurship, according to Susan Andes, IMGT '83. "There are lots of new companies being started here because the market is ready, and this is where the advances in multimedia are being made." Andes is a partner in Multimedia Legal Services Inc., which designs courtroom presentations for attorneys. "In Atlanta, the focus is more on the practical than the theoretical," she says. "Organizations here are interested in applications that can be done on a large or small scale, and that helps people like me coming out of school and starting these small companies.

Atlanta's competition for multimedia leadership comes from disparate and fragmented factions. Nationally, Silicon Valley whiz kids have always been an independent and insubordinate lot, making for a competitive but not necessarily cooperative environment. There are two other regions where major multimedia operations are concentrated: Austin, Texas, where Apple and IBM have moved their joint-venture operations, and Washington, D.C., where a concentration of defense and government industries has created a magnet for software talent.

MARGARET BARRETT PHOTO



Tech grad Ben Dyer has worked with Tech football coach Bill Lewis to develop a line of products for high school coaches that teach the decision-making and mental aspects of team sports.

Crecine acknowledges that Atlanta lags behind other centers in some areas such as computer software, but "there are other areas where we are clearly ahead, such as the technology underlying the cable industry, and the hardware and software associated with fiber-optic networks. We are not yet a dominant player in the area of high-definition television, but the great thing about HDTV is that it's just another digital device."

Crecine's vision of the future is based on the fact that all electronics are headed toward a digitized base, in essence speaking a common binary dialogue. With everything from VCRs to home security systems to stereos operating from a digital base, the next frontier becomes integrating the various systems, and that raises the issue of compatibility, a problem that has long plagued the computer industry.

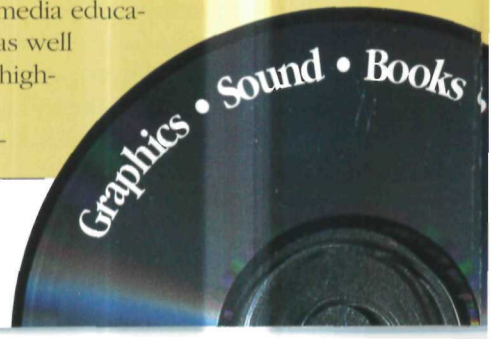
"How can a fairly diverse set of companies and industries learn how to cooperate as well as compete?" Crecine asks. "It's a challenge to bring together a coalition of these industries and make them envision long-term profits and potential new markets as being more valuable than whatever short-term competitive advantage they might have in dividing up existing markets."

"There is a lot of effort being put into addressing compatibility," says Dyer. "It has historically been a big problem, particularly in laser videodisc-based systems. In the home market, over the next couple of years I think there will be no more than two big winners— like the way VHS and beta evolved. There will be a fair amount of standardization around those two, and a lot of the compatibility issues will go away."

At the outset, the biggest uses of multimedia will be in corporate presentations, virtual-reality simulators, education and medicine. Producing these "films" will require many of the same skills used by Hollywood. Instead of the one-dimensional computer jockeys, the multimedia industry requires a more diverse set of skills—a blend of artist and engineer, of computer analyst and director.

"That is one of the best things to come of this," Roden says. "It takes a combination of left and right brain. My people have excellent English and history backgrounds, good writing skills, plus they have solid computing skills. They are not only technically capable, but able to create. They don't have the Hollywood or Silicon Valley extremes."

The state of Georgia has been exceptionally cooperative. By funding the Georgia Center for Advanced Telecommunications Technology (GCATT), state government has made a commitment to multimedia education, as well as to high-tech indus-



try in general. The center's purpose is to further the state's leadership position in the science and technology of telecommunications, information and media technologies, and to stimulate economic growth through programs in those areas. For a state often maligned for its education system, GCATT's role attacks a major societal problem at its roots.

"One of the reasons the classroom has survived is because it is a multimedia environment," Crecine says. "You learn information by seeing, by hearing, by textbook, by audiovisual display. The redundancy of multimedia reinforces things. Education is an area where multimedia has a very clear comparative advantage.

"It is a way of establishing a minimum in terms of the quality of the learning experience. The scarce resource is not going to be hardware and access, but people smart enough to be the movie producer or software writer. It is clear that producing a calculus course or physics course or English literature course will be every bit as complicated as producing a movie.

"That's not to say teachers are going to be replaced, but it will put a pretty high floor on our expectations, which will look like a ceiling in some classrooms."

Because of the tremendous financial stakes involved in multimedia, GCATT director Dick Snelling sees horizons and barriers being conquered faster than had been forecast.

"These industries use very similar technology—software, microprocessors," Snelling says. "All have the same customers. Getting those industries to merge in a more homogeneous way will probably happen before the end of the decade because everybody is after that middle ground—the big money is there."

Snelling added that broadcast television may be the last major industry to join the multimedia revolution because of the huge costs in broadcast equipment.

Fiber optics is fast displacing conventional copper wire in the telephone industry, and digital architecture is moving into all telecommunications industries. Within 10 years, Snelling sees a home multimedia environment that will be fully interactive.

"Consumer electronics in the home would be shared on a common platform," he says. "That platform will be designed to accumulate all the electronic systems in the home—security, life support, TV sets, PCs, energy management, videotext, meter readings—things that tended to be stand-alone systems become shared electronic devices."

As the home multimedia environment expands, the cost of information will go down. At the same time, more sources will be available, from newspapers to the Library of Congress. Corporations will pay for those network enhancements, but will multimedia be economically feasible for the home environment?

"There is a fairly stable willingness to pay for access to information—newspapers, cable TV, telephones and so forth," Snelling says, noting that many households already pay more than $100 monthly for information and entertainment services.

While some futurists believe prices cannot drop much further, Crecine doesn't see an end in sight to the historical law of increasing technological returns. "One of the things that is pretty clear, if you look at the price performance ratio on any device—pick a digital device, or an analog device—technology has made everything affordable," he says.

"I have a computer sitting on my desk that is 10 times as powerful as a $12 million machine in 1965—which would probably be a $40 or $50 million machine in today's dollars. Everyone says there must be a limit, but I haven't seen it."

Crecine, other Atlanta leaders and multimedia entrepreneurs don't believe in limits—either in technology, or in the area's potential to become a major center for what Ben Dyer calls the "new media." ■

Don Hudson, IMGT '79, writes for Gannett newspapers.

MARGARET BARRETT PHOTO

Atlanta has proved fertile ground for multimedia exploration, says Susan Andes, IMGT '83, a partner in Multimedia Legal Services Inc. "In Atlanta, the focus is more on the practical than the theoretical."

There's more on Multimedia on pages 52-53 and 55.

Photos

Of Sights & Sites

The pioneering work being done at Georgia Tech's Multimedia Technology Laboratory helps justify Atlanta's claim as a multimedia center. The lab developed Atlanta's Olympic interactive video presentation, and has also applied an interactive approach to other areas, including adult literacy, math education, architectural simulations and medical imaging. Recently, the lab applied multimedia technology to help the state of Georgia promote economic development.

Until last year, corporations interested in opening a plant in Georgia were treated to a fairly standard routine. Executives were wined and dined, and loaded up with brochures and souvenirs. When it came down to the nitty-gritty of site consideration, Georgia boosters pulled out the "clincher"—a map of the state pasted onto a piece of cardboard.

"Georgia Power had a system that allowed them to store and display information on communities so they could sell the state and their economic development program," says Wayne Hodges, director of the Advanced Technology Development Center. "They wanted to upgrade that system, so they came to Tech."

The Georgia Resource Center was unveiled in October 1991 in downtown hotel. The star of the facility is an interactive multimedia system run by 11 computers and 20 laser-disc players, networked to six large video screens and an executive conference table with a touch-control lighted map of Georgia built into the surface. Here, industrial prospects can get information about Georgia's economic resources in a way that's tailored to their needs.

"Suppose a client wants 100 acres within 25 miles of a major airport, with so many hundreds of millions of gallons of water available, plus certain population demographics," says Frederick B. Dyer, co-director of of the Multimedia Technology Laboratory and primary coordinator for the Georgia Resource Center.

The information is entered into a computer, and all the counties in Georgia that meet those criteria light up on the tabletop map. A trackball-controlled cursor is used to select one of the counties, and smaller tabletop screens light up with specific information about that county—its communities, industrial parks, and other databases of the area.

"When you click on a topic, the big screens display from six to 15 different kinds of data—a mixture of video scenes, bar charts, diagrams and photographs," Dyer says. Information is available in printout form, and visitors may have a videotape made of their Georgia site inquiries.

"This lets companies do a comparative analysis of different locations in the state, and comparisons with other states," says Hodges. "It's an easily used system that does have the fancy bells and whistles, but it also allows you to pull a lot of information together very quickly that gives you a good profile of what particular areas have to offer.

"You don't see that in other states' [presentations]. You see lots of glitzy slide shows and media presentations, but you don't see the usable system that the resource center represents."

Dyer plans to upgrade the presentation with a geographical information system to provide more detailed information. "We also plan to add videoconferencing capability, so the mayor of a prospective site could

talk to the visitors," he adds.

"As far as I know, no one else has anything like it," Dyer says of the center, noting that economic development specialists from France, Sweden and Canada are interested in purchasing the technology.

The Georgia Resource Center is also home to Atlanta Vision, the third incarnation of the Olympic video developed by the Multimedia Laboratory. Atlanta Vision differs from its predecessors in that "as the Atlanta skyline changes, we can add a building or remove a building," says Dyer. "It is designed in an expandable way that, as far as I know, no one else has ever attempted."

Atlanta Vision begins with a view of the world showing cities which have previously hosted the Olympic Games. Olympic ribbons travel from those cities to Atlanta, where they turn into five colored rings floating above the skyline. By rolling a trackball, viewers highlight one of the rings or select an icon on the screen to begin their own interactive multimedia tour of the 1996 Summer Olympics.

Selecting one ring, for example, takes the viewer to Stone Mountain for video, still images and data about the facilities for bicycling, equestrian and other events to be held there. Other selections bring information about Atlanta's transportation facilities, downtown housing, the Olympic village or other events.

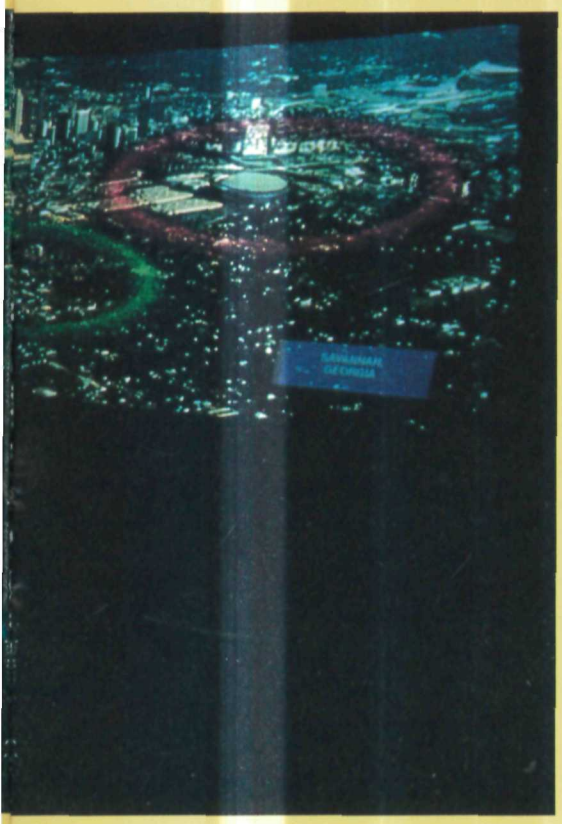
"You can see specific details of each of the various venues, or if you want to take a tour of the city and see the various activities, you can also do that in a visually exciting way," explains Dyer. "There are also short video sequences on the history of the Olympics, the Olympic movement and Atlanta's win."

To maintain the detailed information and organize the video, sound and images, the system relies on an Oracle relational data base. Each screen is driven by a separate IBM PS/2 computer, which is itself coordinated by a computer communicating through a token ring network.

A unique photographic technique allows viewers to see a 360-degree panorama at each location, "comparable to being in a swivel chair moving around and looking at the activities," says Dyer.

The images were shot from a helicopter by producer and lab co-director Michael J. Sinclair, using a motor-driven 35 mm camera. In the studio, the still frames were scanned, corrected for distortion and then electronically composited to provide a complete 360-degree strip picture.

Dyer hopes the Atlanta Vision system will be made at other locations, perhaps as part of a proposed Atlanta Visitor's Center. ■



MARGARET BARRETT PHOTO

Backdropped by an interactive Atlanta map, overlaid with Olympic rings, is Fred Dyer of the Georgia Resource Center.

Would you like to brush up on Japanese social customs and business expressions while en route to Tokyo? Or learn the current value of the Philippine peso before landing in Manila? Maybe you'd rather outwit the Super Mario Brothers, or browse through your own personal video shopping mall—and find your purchases waiting for you upon arrival in Singapore.

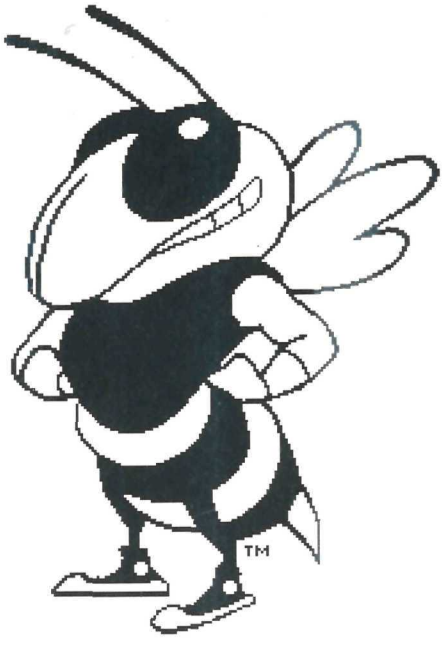
Airline passengers may soon be able to choose from a vast selection of entertainment, shopping, business, communications and tourist information services through an in-flight interactive video system developed by Los Angeles-based Hughes-Avicom International.

"Interactive multimedia will add a tremendous new dimension for airline passengers," says Freeman B. Nelson Jr., EE '52, ME '55, a vice president of the parent company, Hughes Aircraft. "It changes air travel from a passive experience to an active one."

The user's personal link to

Continued on page55

When Georgia Tech Needed a Buzz, They Turned to Crown Roll Leaf



For over twenty years Crown Roll Leaf has been a leading manufacturer of roll leaf products for hot stamping.

Since the development of their first hologram in 1984, Crown Roll Leaf has achieved enviable success producing over a billion holograms for both specialty and mass markets. Crown holograms have appeared on credit cards, magazine covers, Chicago Metro passes, 1991 All Star game tickets and much more.

The enormous universal appeal of holograms makes them a great marketing tool. When Warner Bros. needed a sensational promotional tool to introduce Prince's newest release, they chose to put a Crown stereogram on his compact disc. The decision proved correct when it quickly climbed to the top of the musical charts.

Most recently, to celebrate Spider-Man's 30th birthday, Marvel Comics launched "Spidy" holographically, into third dimension; a first for the industry. Marvel chose Crown for the job not only for their expertise, but because of the time constraints involved. There was only 4 months between the time the decision was made to use a hologram and the publishing date! The Spider-Man anniversary issue became a collector's item immediately.

Crown Holografx, a Division of CRL, is justifiably proud of its state-of-the-art facility in Paterson, N.J. It is the first fully vertically integrated manufacturer of holograms in the U.S. Crown has their own Laser Laboratory and Art Department, which offers originality of design as well as exclusivity. CRL does their own embossing, metallizing, coating and converting. This vertical integration assures product quality, service and confidentiality. Crown has introduced a wide variety of diffraction gratings and special effects patterns for decoration in addition to custom holograms for security and anti-counterfeiting.

Over the past five years, CRL has nearly doubled its annual sales manufacturing over 30 million feet of product each month. With offices throughout the United States and Canada, Crown Roll Leaf has been able to provide customers with high quality products and personalized service.

Crown Roll Leaf Inc
91 Illinois Ave.
Paterson, N.J. 07503
(201) 742-4000

Multimedia & You

Continued from page 53

the system is a display unit, located at each seat and consisting of either a four- or six-inch touch-control color monitor, credit card scanner and computer processor. Passengers can adjust volume, brightness, contrast, color or tint on the tiltable video monitors, which produce sharp, colorful images even when the window shades are up and cabin lights are on.

Simply by touching their choice on the screen menu, passengers may play video games, shop for duty-free merchandise, obtain the latest weather information, select meals and order beverages. They may even watch a movie, travelogue or any number of other video offerings.

Sound is delivered via a multichannel audio distribution system, bringing passengers superior stereo quality, an added number of program selections, and second-language capability.

By tapping into the airliner's 200-megabit computer, passengers will also have access to a data base providing up-to-the-minute information on worldwide currency valuations, connecting flights, tourist attractions and hotel listings. The computer can even generate a map of the destination airport and pinpoint the location of luggage carousels, car rental counters and courtesy busses. Another touch-screen function accesses navigation data, enabling the system user to see exactly where the airplane is at any time on a map of the world, a country or even a city.

A system developed by Hughes-Avicom allows airline passengers to choose from dozens of functions using a touch-screen.

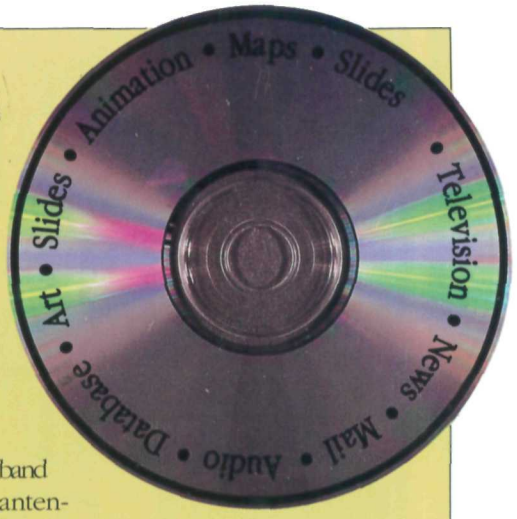
The system also offers advanced communications capabilities. Messages can be "typed" onto the video screen and forwarded like a facsimile transmission to a recipient on the ground.

The interactive system also gives airline crews new cabin management capabilities. A small counter-top computer called the primary access terminal is the crew's direct electronic interface with passengers. Flight attendants can use it, for example, to poll passengers for their menu selections before filling the meal cart, ensuring more efficient meal service.

The pre-flight safety video is activated from the terminal, as well as all movie and shopping-channel videotapes. A crew member can use the terminal keyboard to direct passengers to connecting flights, gates, or provide other information. The primary access terminal also can help crew members keep accurate beverage inventories, tally duty-free sales and provide a printout of the required sales data to customs officials upon landing, and control on-board phone access.

Engineers at Hughes-Avicom are already configuring the next generation of interactive in-flight video, to take advantage of powerful new communications satellites set to be deployed in the next few years.

To receive a good signal from existing satellites requires an antenna more than four feet in diameter—impractical on commercial aircraft because of drag and icing problems. But satellites set for orbit in the mid-'90s will emit signals strong enough to be picked up by low-profile Ku-band antennas less than 30 inches across. Aircraft thus equipped will be able to take advantage of a whole new range of possibilities: live news and sporting events, instantaneous stock quotes, premium entertainment channels—even two-way video-conferencing.



One of the biggest advantages of satellite communication is greater telephone access and voice-signal quality. Today, telephone calls from airplanes are routed via high-frequency radio. Since the radio spectrum is limited, so is the number of phone channels. Usually, no more than four calls can be placed at one time. Moreover, because the radio signal is subject to static, the quality of the communication is often poor. And conversations cannot take place over water for lack of relay stations. The new satellites' digital circuits will provide airline passengers a virtually limitless number of crystal-clear links over both land and water. From his or her seat, each passenger will have immediate access to anyone, anywhere in the world.

Several airlines have already purchased the Hughes-Avicom system, or a similar package produced by its chief competitor, BE Avionics. By the end of the year, at least five carriers will inaugurate the video capability on certain international routes.

In the intensely competitive airline industry, those companies are banking that interactive video will have a positive interaction with their bottom line. ■

IS YOUR RETIREMENT PLAN BETTING AGAINST THE ODDS?

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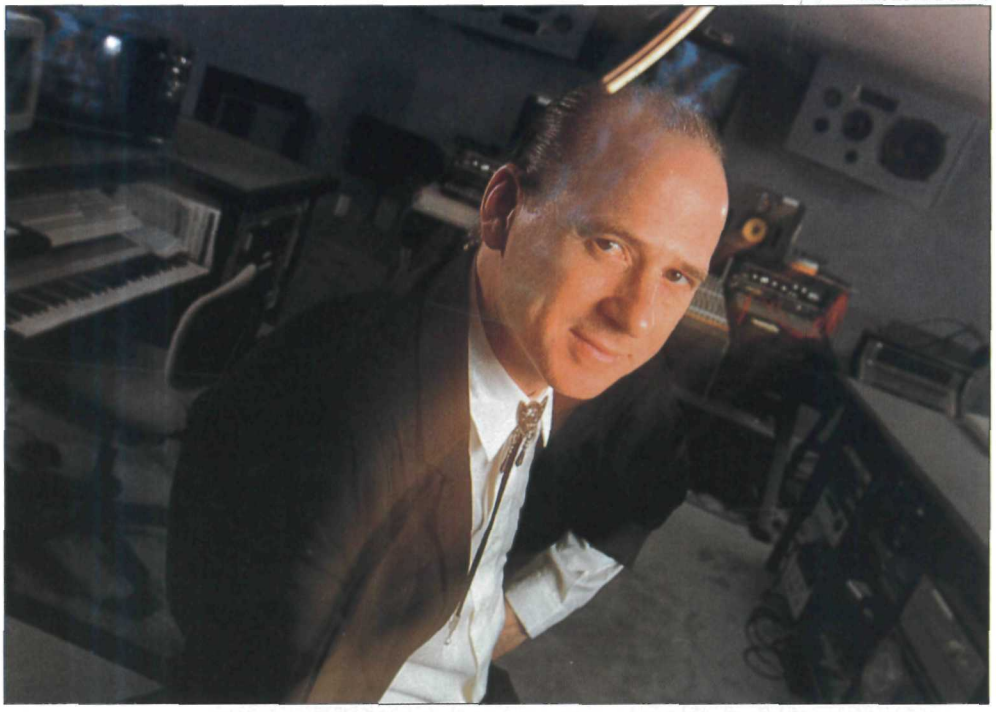
The Music Man

By Phyllis Thompson

BILLY HOWARD PHOTO



Composer of Atlanta's Olympic theme song, Marc Aramian couldn't settle on a career until he found music. Now his is the sound you hear—and often hum—even when you aren't aware you're hearing, or humming, music.

It's peaceful in Marc Aramian's music studio. It overlooks a quiet lake, surface rippled by a gentle morning breeze. The walls and floor of the room are a calming blue-gray; there is no sound.

Until Aramian begins work. He goes to a keyboard and with staccato rhythm starts to tap. He flips on a computer screen; he punches more keys. He stands back, puts a video cassette into a player. The screen fills with color; he presses another button and the music—his music—swells, giving the picture meaning and emotion.

In this placid setting, it's hard to associate Aramian with either the glitz of the recent Barcelona Olympic Games or his celebrity status as composer of "Spirit of Atlanta," a seven-minute feast of music, movement and color aired to an international audience during Closing Ceremonies. It's even more difficult to imagine him as a Georgia Tech industrial engineering student.

Both are pure Aramian, just as are many radio and television commercials. As the backdrop for Coca Cola, Nissan, Valvoline and Days Inn radio and television ads, his music has become so familiar you almost forget it's there. But you'd sure notice if it wasn't.

In 1970, Aramian graduated from Georgia Tech with a degree in industrial engineering. This followed a two-year stay at West Point and a summer military assignment in Germany. He resigned from the military school because "my values changed," he says. "I realized I didn't want to serve a tour of duty after graduation."

Deciding to change his focus to engineering, he researched many colleges and chose Tech. "It was the best," he explains.

For several years after college, Aramian sought fulfillment in his field. He started a plastics manufacturing company. He set up a computer system for an insurance company. He opened a custom furniture shop. He helped start a new construction company in Saudi Arabia.

Nothing seemed to fit.

Until he discovered music.

While growing up in Arizona, Aramian had sung in barbershop quartets with his family. But his music career actually began during an Atlanta production of the Gilbert and Sullivan musical "The Pirates of Penzance," in which Aramian sang the role of the sergeant of police. There, he became friends with former Atlanta Symphony Orchestra conductor Robert W. Mann, and they agreed that in return for some custom furniture, Mann would teach Aramian to read music. "I just wanted to do it for a hobby," says Aramian.

With Mann's help, Aramian learned to read music by writing it. His talent was quickly evident. But when Mann predicted that Aramian would become a composer, both of them laughed. Aramian couldn't even play an instrument.

He still can't.

But Aramian found that once he started, he

Continued on page 59

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Continued from page 57

couldn't stop making music. Three years later, he quit his job to become a full- time composer. For two years, no one was interested in his music. Then he sold a song to Capital Records. He's been selling his work ever since.

Then came the Olympics.

When Jeffrey Babcock, director of Atlanta's Cultural Olympiad, began seeking local resources for sound, videography and production crews, he visited Crawford Post Production. The introduction to the animation house's demo tape caught his attention. "Who did the music?" he asked. "Marc Aramian." The tape continued. Another musical piece caught his attention. "Who did that?"

"Marc Aramian."

Several times more, Babcock asked about musical pieces and each time, they were written by Aramian.

The rest is history. Aramian's music set the pace, the mood and the tone for "Spirit of Atlanta."

Aramian had a week to accomplish his task. The first three days, he spent an hour a day "listening to my mind," he says. "When I'd hear something I thought might work, I'd sing it into a tape recorder."

This process resulted in a series of themes. "When I had an hour's worth, I transcribed to paper," he says, "and began to play with the harmonies. Things began to fit. I started to polish transitions."

It's a process that works for Aramian whether he's composing for a Coca-Cola commercial, a PBS documentary about gizmology, or a special Audubon Society production about mammals.

It holds true during excruciating deadlines—the musician just shortens the amount of time he spends on each step. Aramian only had a half-hour to complete one of his commercials. "On the way to the studio, I started humming some things that I thought might work," he says. "We went from there."

And despite a hectic schedule—"I'm down to 12-hour days during the week and maybe six hours on weekends"—Aramian loves his work. He doesn't feel pressured. "I block out everything except what I hear in my mind," he says, "and I worry about the rest later."

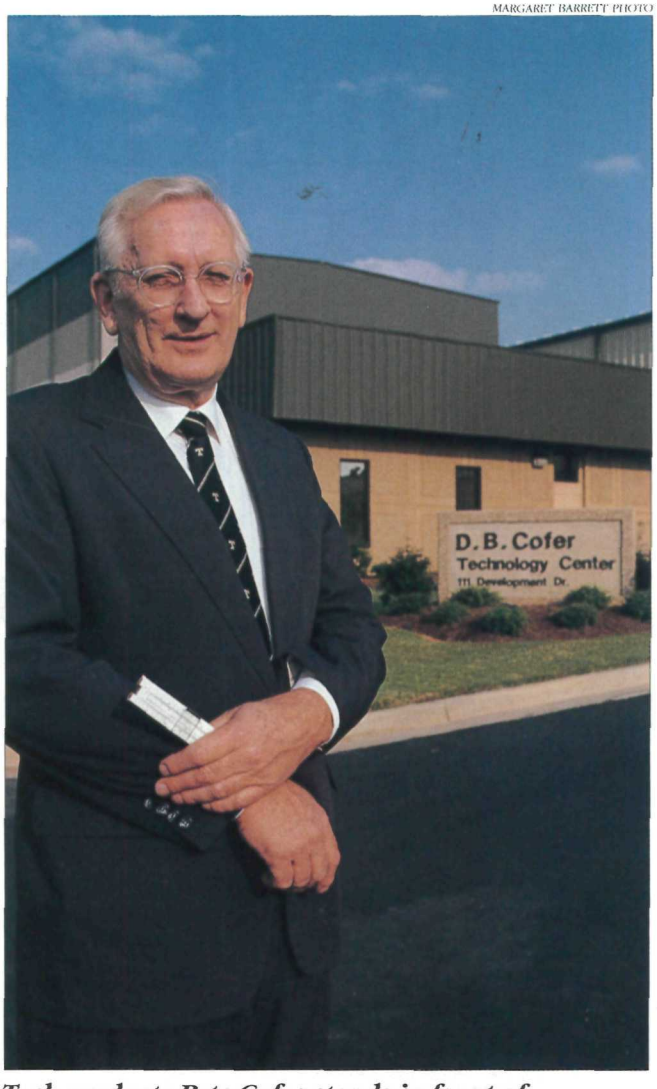
Response by viewers, the press and other musicians to "Spirit of Atlanta" has been very positive. And "creatively, it was very satisfying," he says.

Has the celebrated piece changed his life? "No," he says. "It was just another job."

He smiles as he says it. After all, who's going to believe that? ■

Phyllis Thompson is a freelance writer in Atlanta.

MARGARET BARRETT PHOTO



Tech graduate Pete Cofer stands in front of Southwire's new research and product-testing facility, the D. B. Cofer Technology Center. For 17 years, Cofer has been its strongest advocate. "It will determine Southwire's future," Cofer says.

Southwire's Mr. Technology

By Pam Rountree

D.B. "Pete" Cofer tells about the day in 1953 when he came to the Carrollton, Ga.-based Southwire Co. as a newly graduated mechanical engineer from Georgia Tech. "I was shown a box of machinery and told, 'There it is—you make it work.' "

The machinery was

Continued on page 62

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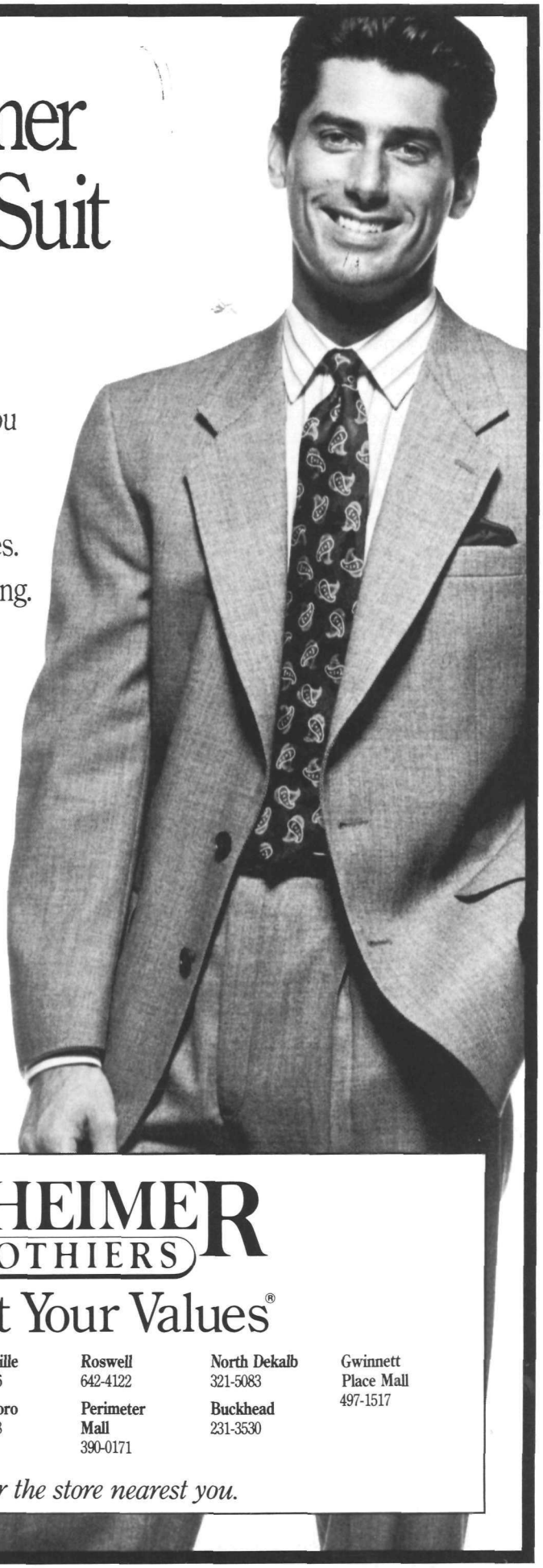

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Continued from page 59

Cofer's advice to Tech students: "Graduate."

Southwire's new aluminum rod mill, and no one could have imagined just how successful Cofer would be at making things work at the company.

"No one personifies engineering and technology at Southwire more than Pete Cofer," says Roy Richards Jr., chairman and CEO of the $1.3 billion maker of wire and cable products.

In recognition of his contribution to the firm over a period of almost 40 years, Southwire has named its new research and product-testing facility the D. B. Cofer Technology Center. The 49,050-square-foot facility serves as an on-site laboratory, and for 17 years, Cofer has been its strongest advocate.

"It will determine Southwire's future," Cofer says. "Without it, we will die on the vine."

By way of example, Cofer states that at the center's metallurgy laboratory, "We are investigating superconductors, which will some day be a product we'll make."

The facility enables Southwire to test products and their environmental safety. One such example Cofer gives is new insulation materials that are safer when burned in a fire.

"We still do a lot of cable testing," he adds. "We test cable that can withstand hurricane-force winds for power companies."

The late Roy Richards, a 1935 mechancial engineering graduate of Georgia Tech and a Carroll County native, founded Southwire on March 23, 1950, to manufacture copper and aluminum wire.

The company's corporate brochure expresses Richards' philosophy: "We do one thing and we do it well. We are the largest and most efficient U.S. producer of aluminum and copper rod, wire and cable for the transmission and distribution of electricity—and the *only* one in the world with its own aluminum smelter and copper refineries."

When Cofer joined the firm, it was three years old and had 50 employees and one plant. Southwire now has 4,700 employees and 16 plants.

Although he is modest about it, Cofer played a major role in Southwire's most significant achievement—a method of making copper and aluminum rod called SCR (Southwire continuous rod). "We've earned a reputation that has established our name worldwide," Cofer says, adding that more than half of the copper rod in the world is produced using Southwire's system. "We're unique in the sense that we're metal producers, in copper and aluminum, as well as wire and cable manufacturers."

Assistant Vice President Ken Kinard, who earned both an industrial management degree in 1965 and a master's degree in management in 1966 from Tech, calls Cofer "the best combination of a businessman and an engineer that I've ever met.

"Pete still does things with his slide rule that most would do on their computer," Kinard says, and Cofer's slide rule is *always* within reach. He even toys with it during the interview. But Cofer is computer literate—he uses four computers in his work.

"Cofer is famous for his contribution to the invention of SCR," Kinard observes. "It has replaced technology that had been in place for 100 years. With the SCR we can make coils up to 16,000 pounds —eight tons—versus no more than 220 pound coils using the old method.

"Pete's hard to classify," Kinard adds. "He's a jewel. His recognition is our customers—the 52 percent of the market we hold and the profits we put on the bottom line."

George Ward, assistant to the executive vice president, has been working with Cofer for 36 years. He recalls that soon after joining Southwire in 1956, "Pete 'borrowed' me to finish a drawing of a machine part he had started. With all of the superlatives that can describe Pete in the fields of engineering, management and business, he has to be the world's worst draftsman. The drawing he had started was a mess. I still don't know if he really was that bad at drafting, or if he just thought that Tech graduates were not supposed to be draftsmen."

Cofer's advice to current Georgia Tech students is simple: "Graduate."

"Today, we can design and build things that people cannot run," Cofer says. "The demand on today's and tomorrow's generation for qualified skills and technical knowledge is going to be much greater."

But Cofer doesn't stop there. Adults, he says, should "continue some form of education—not in a passive, but in an active manner."

After nearly 40 years at Southwire, his work seems like a second family to him, he admits, and jokes, "My wife would probably say it's my first." He and his wife, Dott, have four daughters.

From his very first day at Southwire, Cofer says he has relished his job. "Every day that I come to work, I always have something that I *want* to do and enjoy doing."

Pam Rountree is an Atlanta-based free-lance writer.

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Secrets of Success

By John Carroll

Somewhere in their background—growing up in a small town, managing paper routes, participating in the Boy Scouts, playing high school football, attending Georgia Tech, serving a tour of duty in the U.S. Navy—the brothers Terrell and Pierre Sovey made a discovery: How to succeed in business.

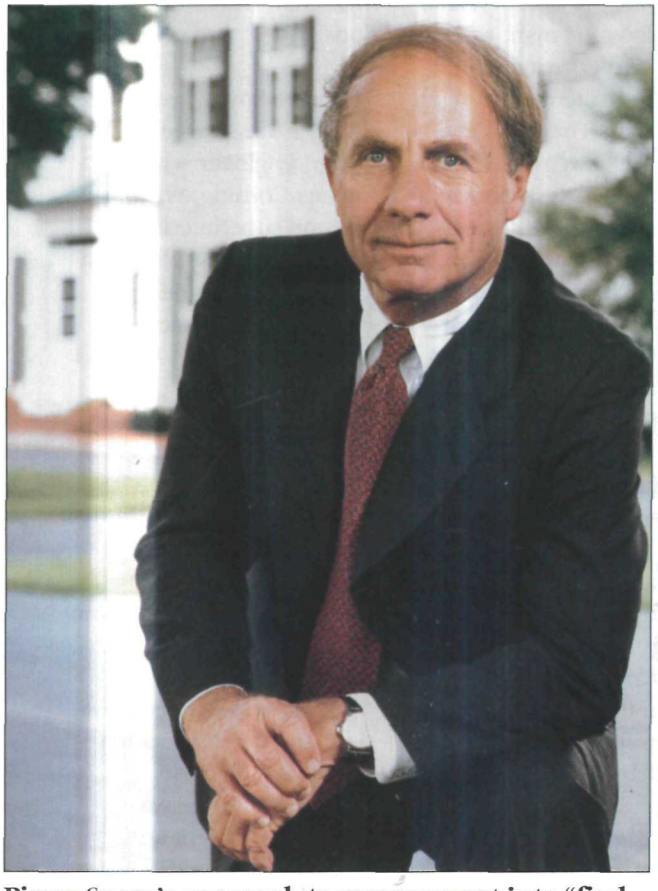
L. Terrell Sovey Jr., a 1952 industrial engineering graduate, is chairman, president and chief executive officer of Raleigh, N.C.-based Texfi Industries. In 1989, he was featured in *Forbes* magazine, and in 1990 he was named "Man of the Year" by *America's Textiles International* magazine. He is also a member of the Georgia Tech Alumni Association board of trustees.

In June, William P. "Pierre" Sovey, a 1955 industrial engineering graduate, became vice chairman of the board and chief executive officer of Newell Co., a Freeport, Ill.-based *Fortune* 500 company.

Between them, they have found success while working for a half-dozen diverse companies. They trace their business philosophies back to their roots.

Growing up Hartwell, Ga., near the South Carolina border, the Soveys say they learned the value of hard work, integrity and honesty by examples set by their parents. Their father was an accountant and their mother a school teacher. They were given responsibility early, either working for their father, or handling newspaper routes. Terrell, who is two-and-a-half years older than Pierre, set the pace. "He was the first Eagle Scout in the county, and I was the second," Pierre says. "Terrell set a good track record for me to follow."

They also developed a



Pierre Sovey's approach to management is to "find good people and give them incentives to work hard." He seeks people who accept responsibility.

KEN HAWKINS/GEORGIA TREND PHOTO

Terrell Sovey's management philosophy includes keeping overhead low and maintaining incentive programs to ensure employee productivity.

"You have to move dirt to go where you want to go."

competitive nature, playing high school football, excelling in academics, and becoming presidents of their respective high school classes. On the gridiron, the squarely-built Terrell was center, and lanky Pierre was quarterback. In a memorable football game against rival Toccoa in 1948, they both had their hands full. Toccoa had a mammoth noseguard named Paul Anderson, who had a reputation for single-handedly dismantling football teams. (Anderson later gained fame as an Olympic gold medalist in weightlifting). It was Terrell's responsibility to keep Anderson from crushing his younger brother.

The Soveys both attended Georgia Tech on Navy scholarships, were in Beta Theta Pi fraternity (Pierre was president), and after fulfilling their Navy commitments, both went to work for Owens-Corning Fiberglas.

Their stints at Owens-Corning, however, were as far as the Sovey brothers' business careers overlapped. Terrell took a job with Milliken & Co. in 1959, and Pierre joined Atwood Machine Corp. in 1963.

Although pursuing different career paths, the brothers have demonstrated a common drive for excellence, a no-nonsense attitude toward hard work, a knack for overcoming adversity, and savvy business skills that propelled them through the corporate ranks. While their business philosophies are similar in style and procedure, the companies they run are different in size and scope.

Newell, with 1991 annual revenue of $1.1 billion, is a rock-solid consumer products manufacturer. Texfi, with 1991 annual revenue of $322 million, is a scrappy textile manufacturer in a volatile industry.

Terrell Sovey worked 18 years for Milliken & Co. Initially given routine tasks, he produced spectacular results. "I'd take a small assignment and make a big deal out of it," says Terrell. "They used to say I was riding a good horse. But I believe you have to move dirt to go wherever you want to go."

Terrell moved up—to vice president of finance and then into general management of increasingly larger divisions. He studied the intricacies of the textile business, learned to anticipate fashion trends and eliminate costly overhead, and he understood the advantage of technology. He left Milliken in 1977 to head a successful turnaround at M. Lowenstein Corp., and in 1980 started his own consulting firm, Management Advisory Services.

As a consultant, Terrell became a founder of Goldtex Inc., a textile printing, dyeing and finishing company, and Precision Cutting Services Inc., which provides computer-controlled fabric cutting services in Spartanburg, S.C., and garment manufacturing services in San Jose, Costa Rica.

He worked closely with Texfi, a company stunned by the collapse of the double-knit market in the 1970s, and the recession of the early 1980s. It was on the brink of bankruptcy in 1984 when Texfi's board of directors, on which Terrell was vice chairman, asked him to be chairman and CEO, a challenge he accepted. "They had given me a very large stock option," he says. "So I took it over. We made a profit in the first quarter."

Terrell's first step toward getting the company in the black was reducing its corporate staff from 200 to five employees. He hired specialists or consultants to handle corporate issues such as accounting, labor law, strategic planning and industrial engineering— a move that he says is more cost effective than carrying such personnel on the payroll. Other moves involved selling off low-margin operations and consolidating profitable ones. He also initiated the strategy of acquiring textile operations with out-of-date machinery and renovating them with modern technology. Terrell says Texfi has invested over $100 million in modernization since 1985.

Today, Texfi exists as a lean, decentralized and highly-automated maker of niche textile products. The company has 4,500 employees and operates three divisions: apparel, finished fabrics and greige fabrics.

Terrell's management philosophy: keep overhead low, maintain incentive programs involving return on assets to ensure employee productivity, and acquire and transform inefficient textile operations.

Pierre Sovey began his business career as a design engineer with Owens-Corning, where he became superintendent of one of its largest plants. In 1963, he was named general manager of the Automobile Division at Atwood Machine Corp., and in 1968 became vice president of the International Division of A.G. Spalding & Bros.

In 1971, Pierre joined AMF Inc. as president of its subsidiary, The Ben Hogan Co. He moved up the corporate ladder until, in 1982, he was elected president and chief operating officer at AMF.

In 1986, Pierre was hired as president and chief operating officer of Newell Co. A leading manufacturer and marketer of high-volume staple

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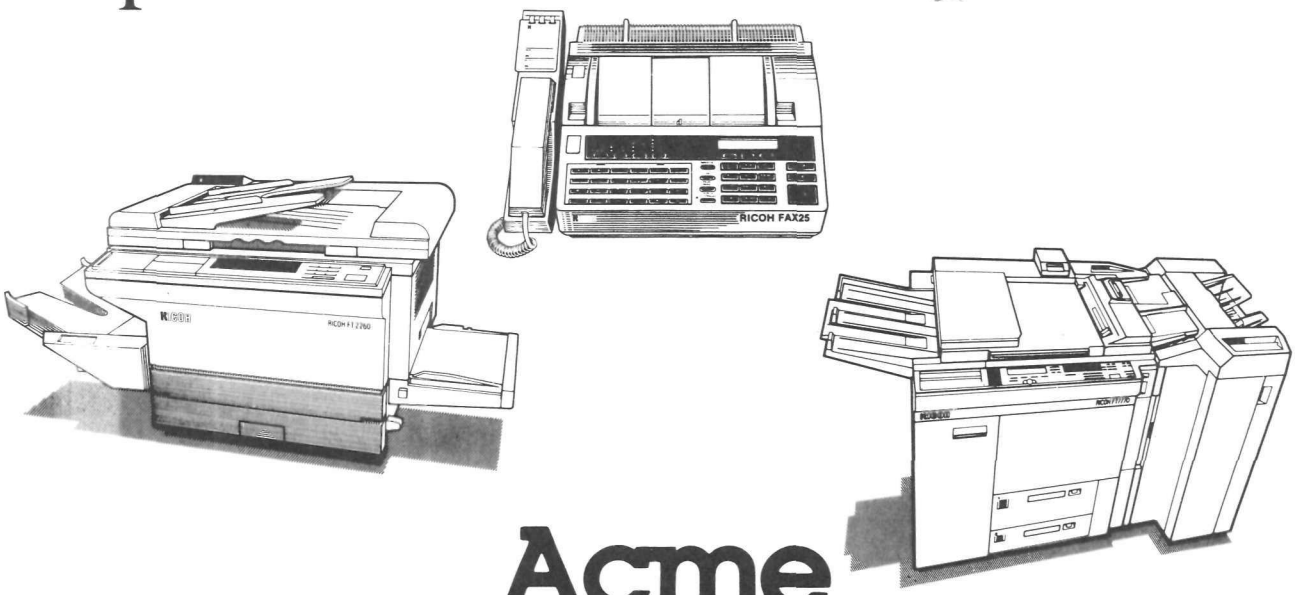

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"We've had a level of thinking that we could do anything."

goods such as hardwares, housewares, industrial and office products, the company supplies goods to such powerhouse retailers as Wal-Mart, K mart, Ace Hardware, Home Depot and Office Depot. The company's common stock was picked as one of the "ten best stocks in the world" to own during the 1980s.

Pierre says the company is focused on internal growth through promotion, selling and merchandising of new products. Newell's financial strength, he says, has enabled it to "do well in good times and pretty well in bad times."

The company also acquires compatible companies with brand-name products and unrealized profit potential, and implements a profit-improvement process that involves improving customer service, eliminating corporate overhead through centralizing administrative functions, discontinuing low-margin businesses, improving manufacturing efficiency and establishing better pricing policies.

Newell, which has 15,000 employees, was built through acquisitions, and Pierre anticipates additional acquisitions in the future as well as overseas expansion.

His management philosophy, Pierre says, is to "find good people and give them incentives to work hard." He believes in accepting responsibility, and looks for people who will accept responsibility.

Georgia Tech helped prepare the Soveys for successful careers, the brothers believe.

"We both knew we wanted to go to Georgia Tech," says Pierre, who also graduated from the Advanced Management Program of Harvard Business School in 1975. "Tech was a very big part of my life."

"Getting through Tech," states Terrell, "gave me self-respect and self-confidence."

Pierre says they both have been instilled with a sense of self confidence.

"We share the same values," says Pierre. "We've always had a positive attitude. That gave us a level of thinking that we could do anything." ■

John Carroll, Mgt '89, is an Atlanta-based free-lance writer.

Sweating for Science

If you're a woman and you like to run long distances, a Georgia Tech researcher has good news. Highly trained female athletes may have an advantage over their male counterparts when exercising in hot, humid weather.

The study of fluid replacement among athletes drinking a carbohydrate-electrolyte "sports drink" shows that highly trained male and female runners matched by age and fitness register some significantly different physiological responses during prolonged running in the heat.

The researchers found no statistically significant gender differences in sweat rates relative to body surface areas, or in levels of dehydration, blood pressure or types of fuel burned. However, male runners lost more blood plasma volume than female runners. Plasma is the watery portion of the blood. Having less of it means less blood is circulating, the heart is pumping faster, and some tissues may lack proper amounts of oxygen.

Male runners also registered lower levels of blood electrolytes such as sodium and potassium than did females. The researchers had expected the men to have more concentrated blood, and thus higher particle levels, because they lost more fluid than the women did.

The researchers also found that the women's body temperatures were cooler than the men's by about 0.7 degrees Celsius at the end of the race. Thirty minutes after the race, the women were cooler by an even greater amount—1.1 degrees Celsius. Researchers speculate that the temperature difference may mean that women sweat more efficiently than men.

Followup studies may determine the causes of the gender differences, but research in the area could influence formulations of carbohydrate-electrolyte sports drinks.

In a study of "sports drink" effectiveness, Tech scientist Dr. Mindy Millard-Staffard and an assistant measure oxygen consumption of a runner.

Atomic Migration

Don't look now, but strange things may be happening deep within your computer's microcircuits, as atomic-scale hills and valleys grow on the thin metal conductors used to carry electronic information.

Known as solid-state electromigration, this microscopic construction activity causes premature failure in electronic devices. As circuit designers shrink the size of electronic components to crowd more and more of them onto chips, electromigration becomes increasingly important.

To help learn how to minimize failures caused by electromigration, a team of Georgia Tech scientists is using powerful microscopy techniques to study the growth of these hills and voids. Based on their research, the scientists believe that atoms are displaced by electromigration in much the same way they are moved during mechanical deformation.

Mechanical deformation occurs when malleable metals are stretched, bent or hammered. The process causes enormous displacement of the atoms through activation of dislocation dynamics.

Electromigration causes similar atomic displacement as high-density current moves atoms around in thin films. This similarity led the Tech team to undertake tests to confirm the correlation between electromigration and dislocation mechanisms.

Armed with an understanding of the mechanisms involved in electromigration, the researchers hope to devise the best materials combinations to improve the reliability of electronic circuits.

Radar Simulator

Radar researchers at Georgia Tech Research Institute have developed a computer simulation that assesses factors affecting radar performance and predicts how well a given system will work.

The program could reduce the time and effort radar engineers spend searching for information and testing and compensating for factors called contaminants.

The computer simulation runs on BASIC or MATLAB software on IBM-compatible or Macintosh computers. An engineer enters the parameters of a

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Study promises improved radar warning

particular radar system, including the relative size of the targets the system must detect and the characteristics of the contaminants. The simulation presents a graphic display indicating how well the system will perform. The program produces color plots of the Fast Fourier Transform process in one- and two-dimensional formats, showing the effects of the contaminants. Researchers continue to improve the system, making it better able to address individual users' needs.

Radar Warning

An improved acousto-optic radar warning receiver developed at Tech may provide future combat pilots with faster and more accurate warning of hostile radar activity.

Optical signal processing techniques allow the receiver to simultaneously handle a wide range of frequencies, and analyze several signals in parallel while providing frequency resolution precise enough to separate hostile signals from friendly ones.

A pair of acousto-optic cells, each with a specific processing task, form the heart of the radar-warning receiver. At the first cell, a transducer converts electronic signals from a potentially hostile radar emitters to acoustic energy. That energy is then coupled into the cell, where the acoustical energy affects its optical properties. Infrared laser light is then passed through the cell, which diffracts the light in a different direction for each center frequency it receives.

The diffracted light then strikes a second acousto-optic cell, which further diffracts the laser light so that the burst rate associated with each center frequency can be determined. Finally, detectors convert the diffracted light patterns to electrical signals which can be displayed.

Researchers hope to enhance their system by adding the ability to automatically match the diffraction patterns against a library of known threat radars. They also plan to miniaturize the receiver. ■

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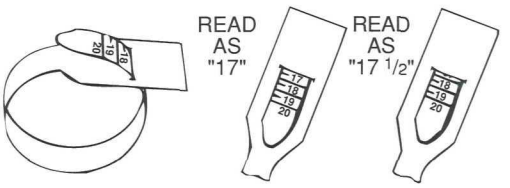
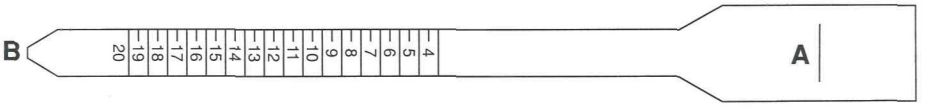




Bridging Disciplines

By Michael Pousner

Dr. Robert M. Nerem is a self-described late bloomer, so much so that he scored at the fourth-grade level on an eighth-grade standardized mathematics examination in his hometown of Evanston, Ill. His math teacher, however, took him aside and said, "I know you're smarter than that, and I've made special arrangements for you to take the test again."

This time, Nerem scored at the 12th-grade level, and began a stellar academic career. "My teacher believed in me, and she basically turned me around by getting me to believe in myself—that I wasn't a 'C' student, but an 'A' student," remembers Nerem.

A dark-haired man of 55 who looks you straight in the eye as he talks, Nerem has never forgotten the lesson from his math teacher. He values his teaching at Tech, particularly his undergraduate course on convective heat transfer and the challenge it offers for similarly turning other young lives around.

An Institute Professor at Tech, Nerem was chairman of the Department of Mechanical Engineering at the University of Houston when he was named in 1987 to fill the Parker H. Petit Distinguished Chair for Engineering and Medicine in the School of Mechanical Engineering.

"What attracted me to Tech was not so much the chair, though that was frosting on the cake," he remembers. "There was also a sense of an institution that had its act together as far as bioengineering goes. Many universities say they support bioengineering, but it's a fragmented effort. Here, there was the willingness to really support it."

His academic career—what he calls his "journey"—has been marked by taking on ever-greater responsibilities in an attempt to broaden beyond the field of aeronautical engineering, in which he has his PhD. His research has taken him to the frontier of the bio-medical field and into an interdisciplinary region where engineering, medicine and science coexist. It is part of his ongoing effort to study blood flow to see how it influences maladies like heart disease and arteriosclerosis. Nerem notes that certain arteries can be diseased and certain ones are not, and the same goes for regions of the same artery. He believes this localized pattern is dictated by the interaction of blood flow with the biology of the vascular wall.

"We think that by understanding how the blood flow influences vascular biology, we can better understand vascular diseases and disorders and the therapeutic measures to treat them," he explains, his words flowing in torrents.

Nerem is working on a long-term goal to combine growing, living cells and extracellular matter in a laboratory to make a living blood vessel.

Nerem's office on the third floor of Weber Space Science and Technology Building has a ceramic model on the wall depicting velocity fluctuation in aortic blood flow, and a picture of a fiberblast cell undergoing division.

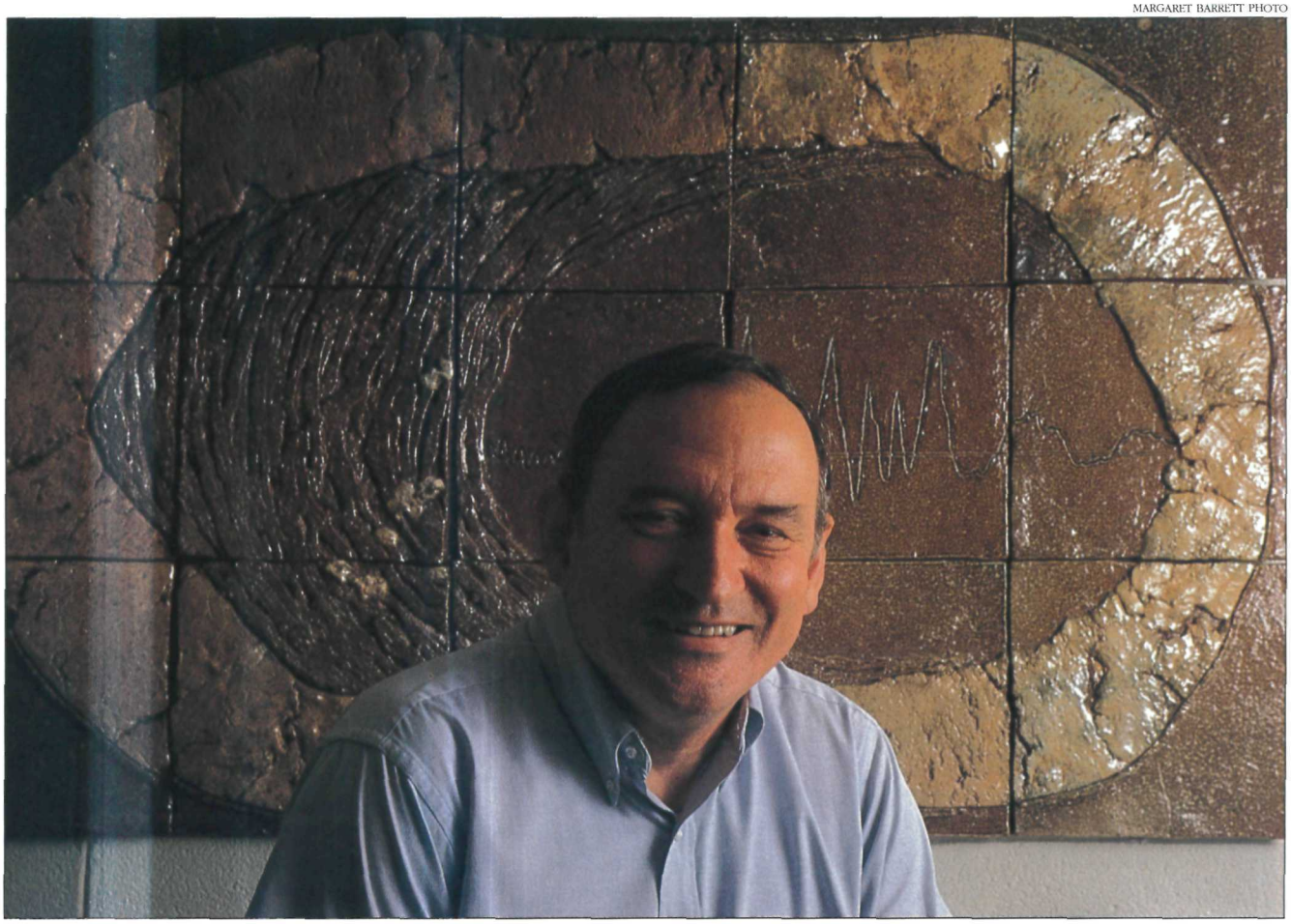
When Nerem was an aeronautical engineer at Ohio State, NASA sought his consultation regarding the problem of vibrations on the Saturn rocket launcher. NASA wanted a consultant on a medical school project to study the vibration's effects on human physiology.

"It was a window on biology and medicine, and thinking about it from an

The Nerem File

- **Born**—Evanston, Ill.
- **Education**—BS, University of Oklahoma; MS and PhD, Ohio State University.
- **Family**—Wife, Marilyn; he has a grown son, Robert "Steve" Nerem, and a grown daughter, Nancy Chambers.
- **Quote**—"Some of the key research issues today are ones that fall between traditional disciplines—in my case between biology, medicine and engineering. Hot areas come and go, but we definitely see today the interfacing between two or three disciplines."
- **Professional Interests**—Research interests include biofluid mechanics, cardiovascular devices, cellular engineering, vascular biology, and atherosclerosis. He enjoys teaching both graduate and undergraduate classes.
- **Leisure Activities and Interests**—Playing tennis and exploring faraway lands, acquiring artifacts that line the walls of their home.
- **Persons most admired**—My mother and father; Mrs. Wilbur, an eighth-grade math teacher who "turned my life around"; Professor Y. C. Fung at the University of California, San Diego, who is the "father of my discipline."

MARGARET BARRETT PHOTO



Robert Nerem: A pioneer in the interdisciplinary frontier where engineering, medicine and science co-exist.

engineering perspective was very interesting," Nerem remembers. "I went off in 1970 and spent a year at the Imperial College of Science and Technology in London, and when I came back I decided to move my research out of aeronautical engineering and into biomedical engineering. You might say my journey started with an entry in aeronautical engineering, and I'm now doing cell biology.

"In many ways some of the key research issues today are ones that fall between traditional disciplines—in my case among biology, medicine and engineering."

Nerem praises Georgia Tech for the freedom to move through different disciplines. After a lifetime in academia, Nerem observes that "the structure of a university is a very traditional structure, and the only way you can move beyond that structure is through the good will of some good people."

Nerem's parents were natives of Norway. The family moved back to Norway when he was a young boy, but later returned to Evanston. Nerem received his BS at the University of Oklahoma and his MS and PhD degrees at Ohio State. He joined the faculty there, and served from 1975 to 1979 as associate dean for research at the graduate school.

Nerem holds a number of leadership positions in international societies, and lectures and attends meetings abroad incessantly. He was recently elected to membership in the prestigious Institute of Medicine of the National Academy of Sciences (one of the few non-medical people to be so honored). He is president of the International Union for Physical and Engineering Sciences in Medicine, and immediate past president of the International Federation for Medical and Biological Engineering. He is a member of the National Academy of Engineering, and in 1990 was presented an honorary doctorate from the University of Paris. Earlier this year, Nerem was appointed a member of Georgia Gov. Zell Miller's Advisory Council on Science and Technology Development.

"Bob pretty much lives, eats and breathes his work, but one of his greatest skills is bouncing 10 balls at once," says his wife, Marilyn. "He'll be sitting at home writing a paper with the television on, and if I interrupt him, it doesn't bother him. He's able to switch gears very quickly."

"I love my work," Nerem states with a smile. "As a matter of fact, I tell people that I don't work. I am one of those fortunate people who puts in a lot of hours for which somebody decides it's worth paying me." ■

Michael Pousner is an Atlanta free-lance writer.

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