Georgia Tech

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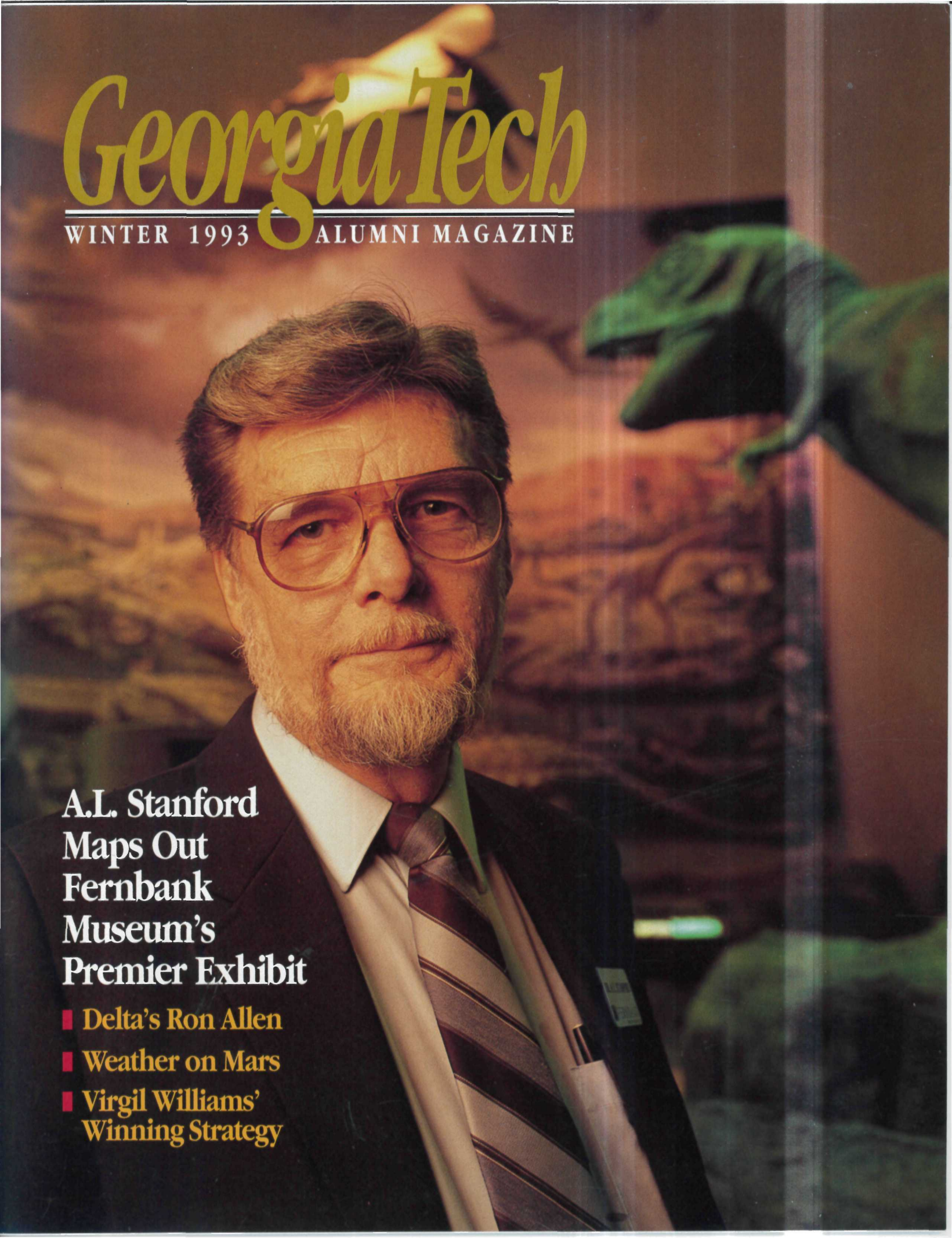

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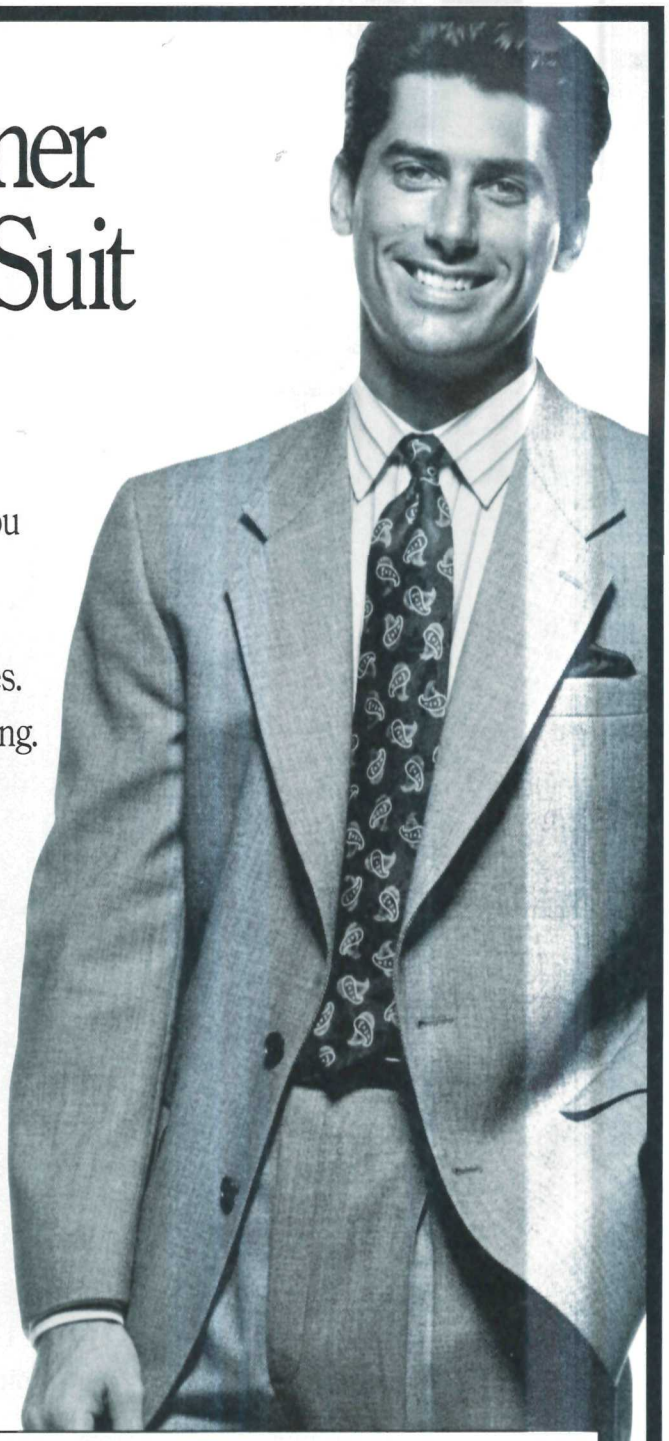

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COVER: *Over a six-year period, Georgia Tech physicist Augustus L. Stanford Jr. charted* Walk Through Time in Georgia, *the theme exhibit of the new Fernback Museum of Natural History that opened recently in Atlanta. For more on the South's premier natural history museum, see story beginning on page 14.*

BILLY HOWARD PHOTO

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In the Swim

By Gary Goettling

Plans for the Olympic natatorium at Georgia Tech took a huge step forward when the Board of Regents approved a compromise agreement between Tech and the Atlanta Committee for the Olympic Games.

The swimming venue will be an open-air structure covered by a fabric roof and cooled by portable air-conditioning units. Tech had pressed for an indoor facility, but the extra funds needed were not available. ACOG did agree to have foundations installed so that a building could be erected over the site at a later date.

The natatorium will contain an Olympic-size pool, diving well, warm-up pool and 19,000 seats. It will be located behind the O'Keefe Building on the east side of campus, rather than next to the Student Athletic Complex as originally planned.

Construction of the $15 million facility is expected to begin later this year.

Power Lunch

It was a real power lunch—Georgia Power, that is.

About 170 Tech alumni who work for the utility gathered for lunch at company headquarters in Atlanta on Dec. 9, and to hear presentations by President John P. Crecine and Georgia Power's executive vice president, Dwight Evans, CE '70.

Evans had organized the meeting in an effort to stir up interest in creating a Georgia Tech club at the company, which is one of the top five employers of Tech alumni in the nation.

✔ *For information about starting a corporate Georgia Tech club, contact Rob Stanek at (404) 894-9275.*

What's in a Name?

The Alumni Placement office changed its name to Alumni Career Services, effective Jan. 1, and will move its offices to the recently completed Success Center.

The name change does not reflect any change in services, but is an effort to more accurately reflect the department's function, according to Alumni Association Executive Director John B. Carter Jr., IE '69. "We don't really place anyone," he says. "We're actually a resource and a facilitator between potential employers and alumni who are looking for a job or a career change."

The Alumni Career Services office publishes a free weekly bulletin containing job openings, maintains a file of alumni resumes as a resource for corporations, and sponsors an annual Career Conference.

At last, the contents of the Tech Tower have been revealed.

New Master's Degree

The Board of Regents has approved two new master's degree programs at Georgia Tech, in bioengineering, and information, design and technology.

The bioengineering curriculum is an interdisciplinary program that grew from joint research at the Emory-Georgia Tech Biomedical Technology Center. Although there are no plans for an undergraduate bioengineering degree to replace the certificate currently offered, a PhD in that area may be proposed next year.

The master's in information, design and technology involves a communications curriculum in a high-technology context. It is offered through the Department of Language, Communication and Culture.

Inside the Tower

The stately Tech Tower has been a campus symbol and focal point for more than 100 years. So for all its significance, what is actually inside the tower at its uppermost levels? Gold? Important documents? Old tests? George P. Burdell?

The answer is: nothing. It's two stories of open, vacant space.

"The only people who go up there are the guys who have to replace the T," says Beverly Peace of the facilities office. "Students climb up from the outside to steal it."

The only lingering evidence of human visitation is the decades-old graffiti scratched into the walls.

"Apparently students as far back as the 1930s would go up there and just hang out," she says.

Jacket Bowling?

The Georgia Tech Yellow Jackets are going to a bowl game—sort of. Tech officials have signed an agreement with Touch-

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Crecine: "We have the potential to have the best-ever Olympic Village."

stone Pictures to use the football team's name in an upcoming motion picture, "The Program," starring James Caan. Caan will portray the football coach of ficticious Eastern State University. The script calls for ESU to lose a bowl game to the Jackets at the beginning of the film, but after a year of rebuilding, the gritty ESU players defeat Tech in a Rocky-esque rematch.

Crecine's View

President John P. Crecine attended the 1992 Olympic Games not so much as a spectator, but as a student of Olympic planning.

"The most surprising and great thing was that the people of Barcelona, even though they didn't go to the athletic events, were out and around and really created a festive atmosphere," he says. "I think the atmosphere outside the athletic competition was as exciting as the competitions themselves."

Crecine says that Tech will provide a better Olympic Village because it is a college campus.

"We're a city where almost 13,000 students show up every day," he notes. "We've got an infrastructure, in addition to housing, to support a population similar to the Olympic athlete population. We have the potential to have far and away the best Olympic Village ever."

Crecine observed that, from a spectator's point of view, there are two Olympics. "Hardly anyone stays the whole 16 days," he says. "They can't afford it. What you find is that people will come for the Opening Ceremony and stay for the first week. Then there's an 80 percent turnaround.

"There is nothing between the Opening and the Closing ceremonies. But halfway through the Games, there's a whole new group of people who may need to be energized. Maybe a second ceremony or some special event halfway through would make sense. That's one of the things I'd never have realized had I not been there."

United We Stand?

A fascinating new book, *Where We Stand* [Bantam: New York], compares the United States with other industrialized nations in a number of categories ranging from the empirical, such as number of automobiles per person, to the subjective, such as standard of living.

Using the most current data available from government and United Nations sources, the editors rely almost exclusively on graphs and charts in making their comparisons. *Where We Stand* was the sourcebook for the PBS series "Made in America."

Among findings:

- The U.S. is a big winner in terms of the number of Nobel prize recipients in the sciences during 1950-1990, with 138 Americans claiming honors. The United Kingdom placed second with 40.
- Japan leads the world in the proportion of engineers and scientists with 5.0 per 1,000 population. The U.S. is second at 3.3.
- The U.S. controls 57 percent of the world's software market, followed by Japan with 13 percent. France is third (8 percent).

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Students recreate 'Buzz' . . . sort of

• Only 2 percent of U.S. high-school seniors are taking advanced chemistry. The list is topped by Canada (25 percent), followed by Japan (16 percent), Finland (14 percent) and Australia (12 percent). Italy is at the bottom with 1 percent.

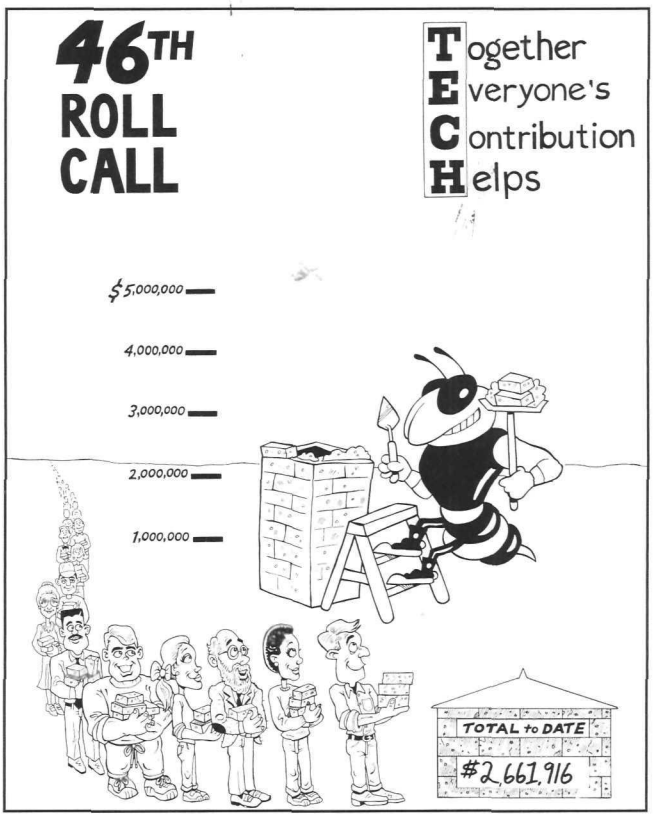
Times 2

A recent survey by Texas A&M University revealed that Georgia Tech's research program in the College of Architecture is generating gross revenues totalling $4.1 million. While comparative rankings have not been completed, Tech placed second two years ago with research revenues of about $2 million.

The College's research effort is focused in three centers working with rehabilitation technology, construction and architectural conservation.

Robotic Buzz

Georgia Tech students made a pretty good showing at the Mobile Robotics Competition recently in San Jose, Calif. Buzz, the entry in the autonomous robot contest, placed fifth against machines from nine other universities and



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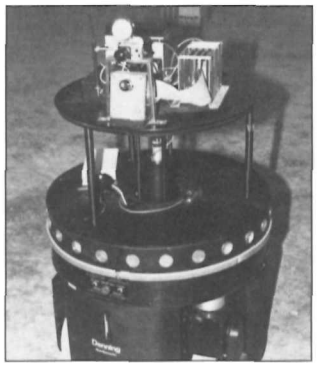
laboratories.

The robots competed in a three-stage event that began with simple obstacle-avoidance techniques, and finished with tasks that required memory and problem-solving ability. No robot was able to successfully complete the entire course, demonstrating the tremendous difficulty in programming robots to operate in real-world environments.



Buzz in the 21st Century?

"The successes in robotics to date have been so limited...because of the errors in sensing," said Tech team advisor Dr. Ron Arkin, a professor in the College of Computing. "Like humans, robots need sensory feedback even when they have a map." The Tech robot was equipped with a camera, sonar and infrared range finders. ■

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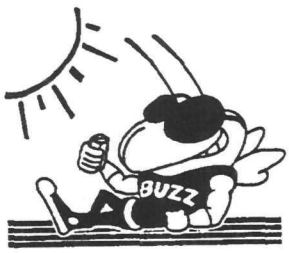

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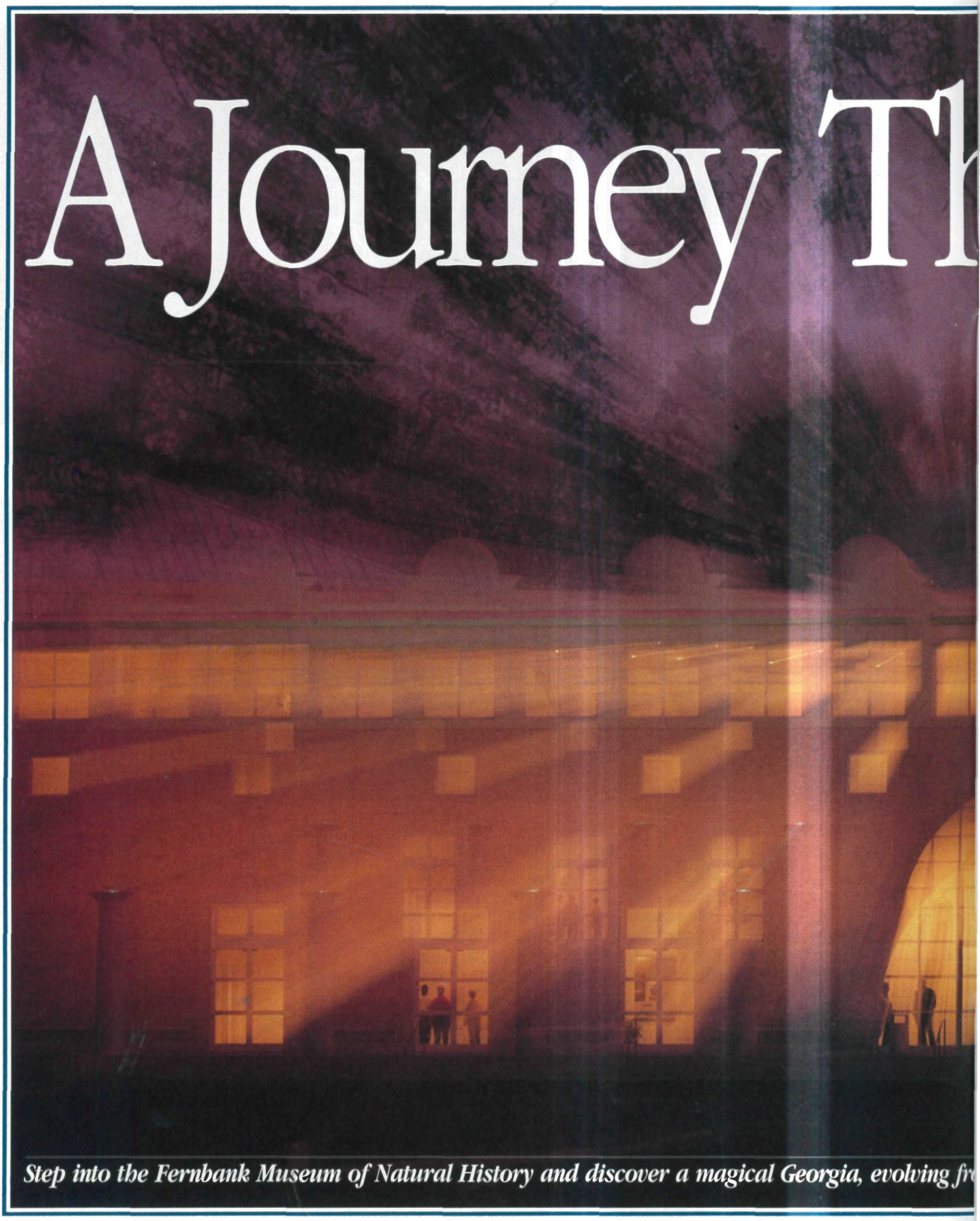

Step into the Fernbank Museum of Natural History and discover a magical Georgia, evolving fr

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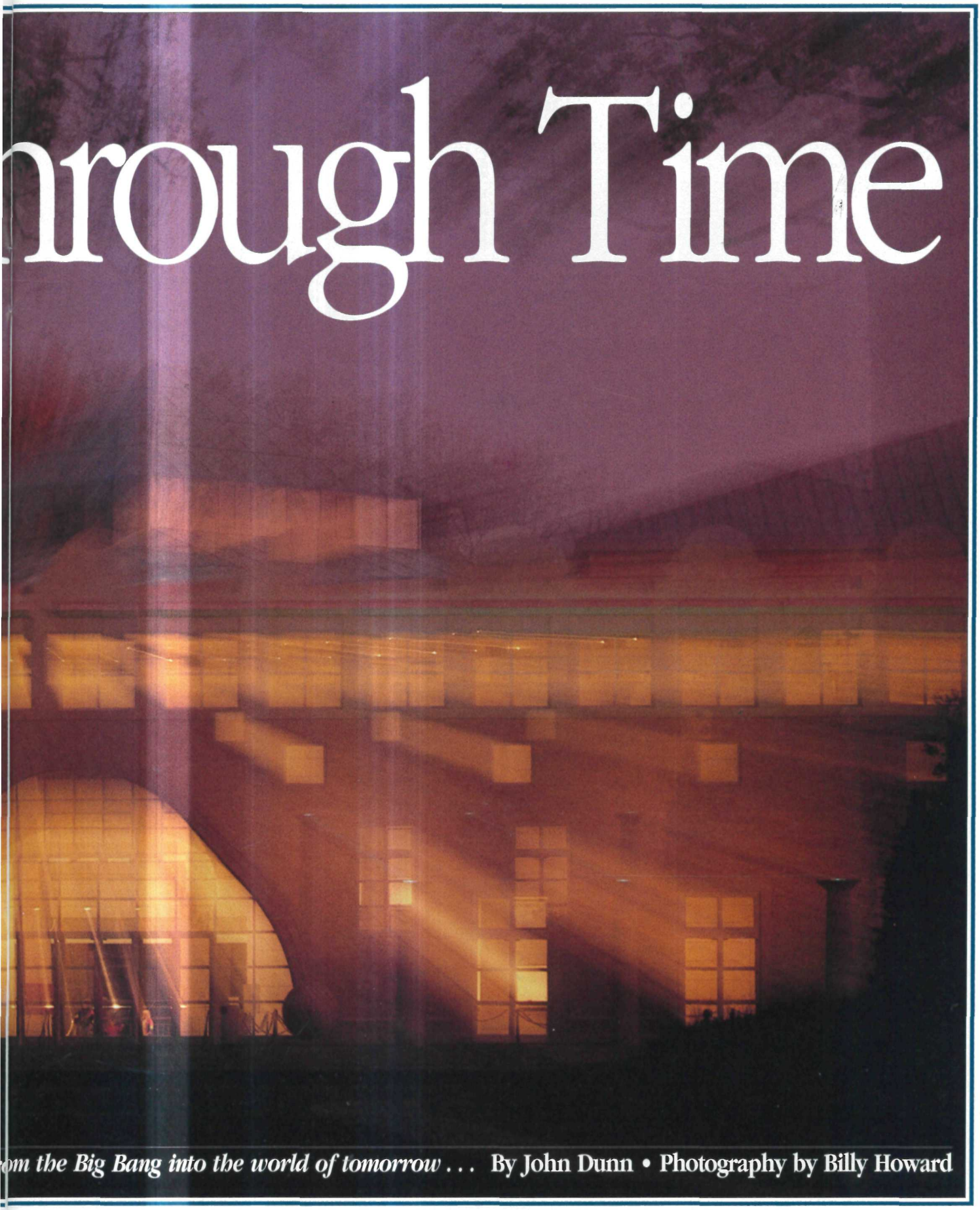


om the Big Bang into the world of tomorrow . . . By John Dunn • Photography by Billy Howard

***In the midst of all the wonders, a pterodactyl soars above a prehistoric landscape . . . Welcome to the world of Tech physicist Augustus L. Stanford Jr., an alumnus who charted* Walk Through Time in Georgia**

The lights dim in the Cosmos Theater. On a screen that sweeps across the wall, the "big bang"—the stupendous event that scientists say marked the beginning of the universe some 15 billion years ago—is about to explode before your eyes.

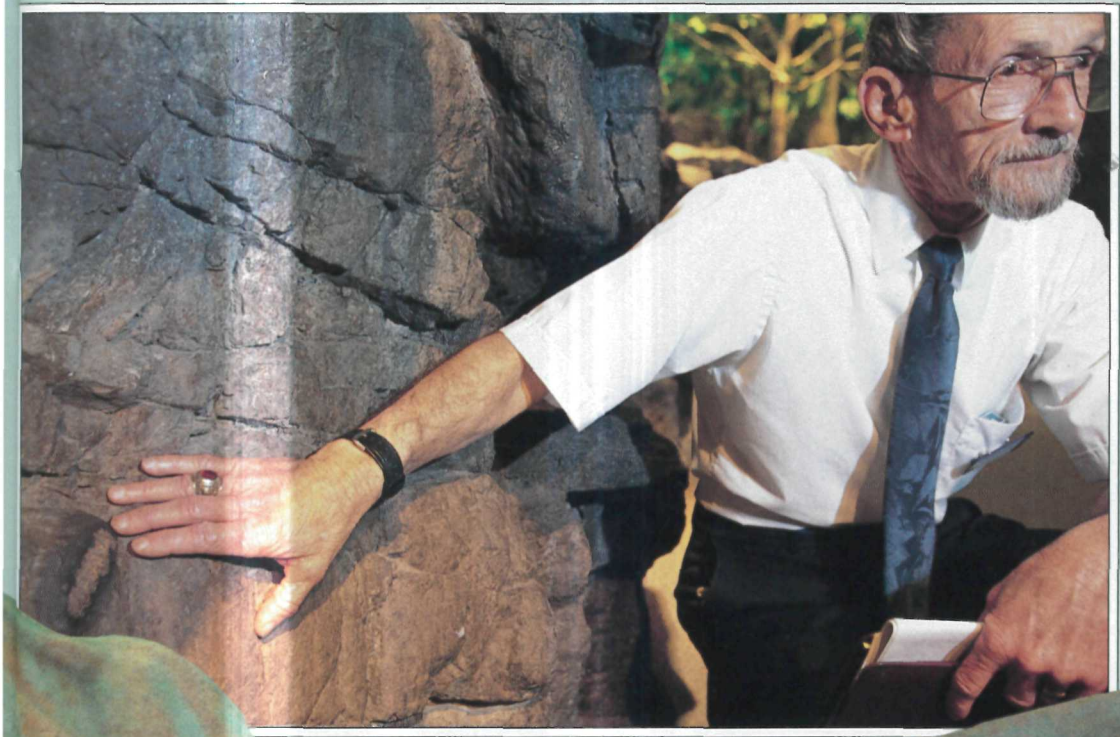
You have taken the first step on a *Walk Through Time in Georgia*, the dramatic theme exhibit of Atlanta's Fernbank Museum of Natural History, and begun a high-tech journey to explore Georgia's diverse geological regions, and observe the natural history of Earth. In the midst of all the wonders, you encounter a pterodactyl soaring above a prehistoric Georgia landscape—the realm of the Ruling Dinosaur Gallery, dominated by six life-size dinosaurs and murals depicting the Cretaceous, Jurassic and Triassic eras.

Welcome to the world of Georgia Tech physicist Augustus L. Stanford Jr., an alumnus who charted *Walk Through Time in Georgia*.

Shortly after Dr. E. Kay Davis became executive director of the Fernbank museum project in 1984, Stanford was given the task of researching and developing the content for the museum's central theme.

During the next six years, Stanford researched material for the exhibit's 17 galleries. He also wrote much of the informational material that guides visitors through the galleries, as well as scripts for some of the video presentations.

The $43 million Fernbank Museum, which opened last October, is located on the edge of a 65-acre primeval forest in DeKalb County. The 160,000-square-foot majestic tan-brick and glass structure is the largest museum of natural science south of the Smithsonian in Washington.



A giant among giants is the lifesize model of the Albertosaurus, one of six dinosaurs in the museum. The dinosaur roamed Georgia about 80 million years ago. LEFT: A tour guide points out a replica of a crinoid (sea lily) fossil, evidence of the state's underseas era. FAR LEFT: In the Ruling Dinosaurs Gallery, children watch a hadrosaur hatch out of its egg.

In addition to its 15,000-square-foot *Walk Through Time in Georgia* permanent exhibit, the museum features a Great Hall, an 8,000-square-foot atrium that rises six stories into a glass crown; an IMAX theater with a 52-by-70-foot screen and an auditorium seating 300 (the IMAX lobby is a star chamber simulating Atlanta's night sky, containing 541 stars illuminated by 3,000 optic fibers); Fantasy Forest and Georgia Adventure, two children's exhibits; a dinosaur overlook; and a 15,000-square-foot hall for visiting exhibits.

The minute you step inside Fernbank, you have stepped back in time. The fossilized floor is made of limestone tiles from a Bavarian quarry in Solnhofen, Germany, that contains 150-million-year-old fossils—including belemnite (small cigar-shaped ancestors of the squid) and snail-like ammonite.

Fernbank is unlike traditional museums.

"We didn't have a collection around which to base a museum," Stanford explains. "Fernbank's trustees decided that by re-creating the seven geophysical regions of Georgia and relating them to past history, we could

With technology ranging from computer visualization to interactive video displays, visitors are able to leap-frog through time.

The flow of human history is evidenced in the exhibit tracing humankind's migratory path from the cradle of Africa to the Americas. RIGHT: History comes alive for Joshua and Esther Lannu, fascinated explorers from Montezuma, Ga., who are dwarfed by the giant ground sloth.

teach the natural history of Earth using Georgia as a microcosm."

A native of Macon, Ga., Stanford received his BS, MS and PhD degrees in physics from Georgia Tech. He is the author of three textbooks on physics and is currently writing a book version of *Walk Through Time in Georgia.*

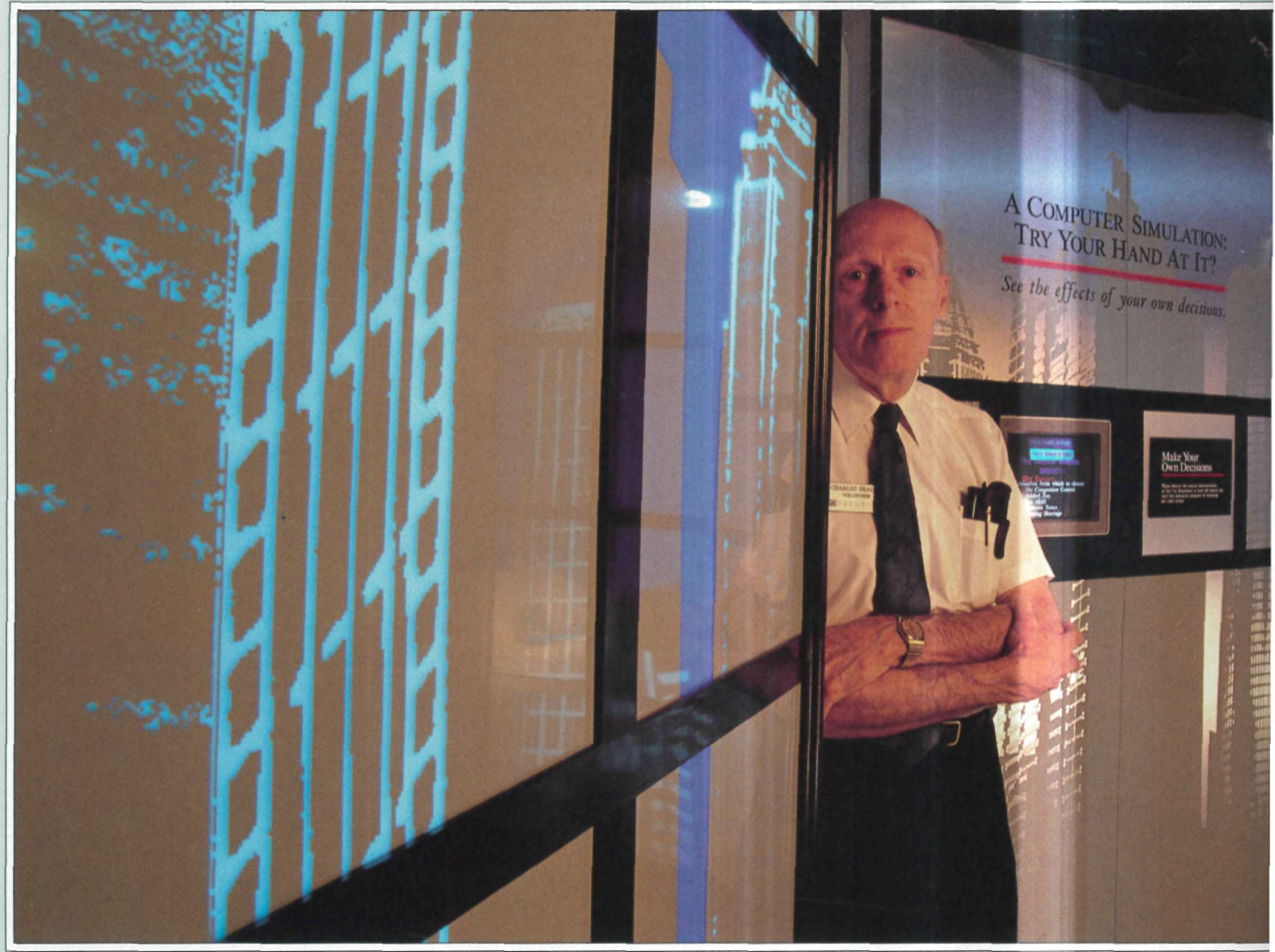
Walk through Time is told with a high-technology flair, utilizing high-definition laser video, fiber-optics, computer visualization and interactive video displays that allow visitors to leap-frog across time as they stroll through the galleries.

Galleries of each of Georgia's seven geological regions represent the state's scenic beauty, featuring native plants, wildlife, rocks, soil and seasons.

Scenes include wild turkey at a granite outcrop in the *North Georgia*

Megatherium: A Giant Ground Sloth of the Miocene Epoch

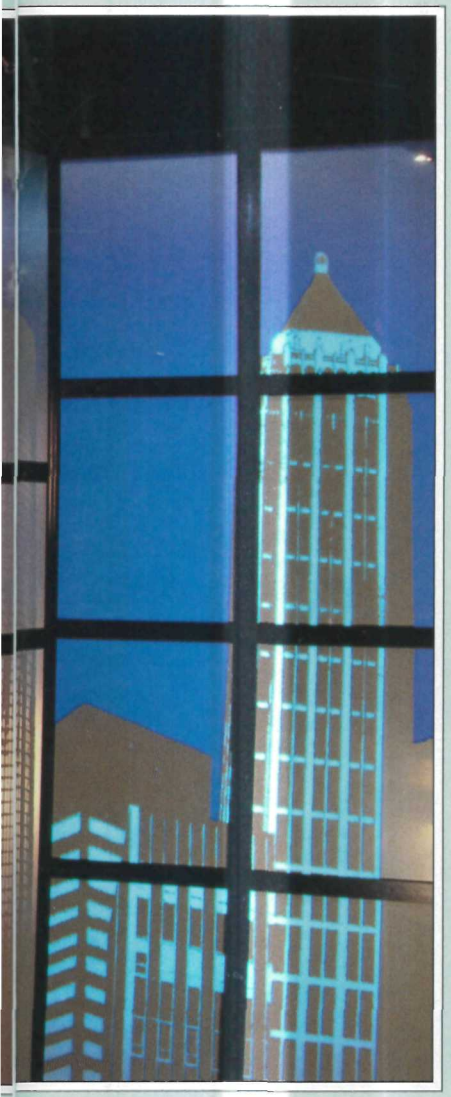
Ten galleries present a chronological history of the Earth, beginning with the Big Bang—a stunning laser disk projection that dazzles in sight and sound.

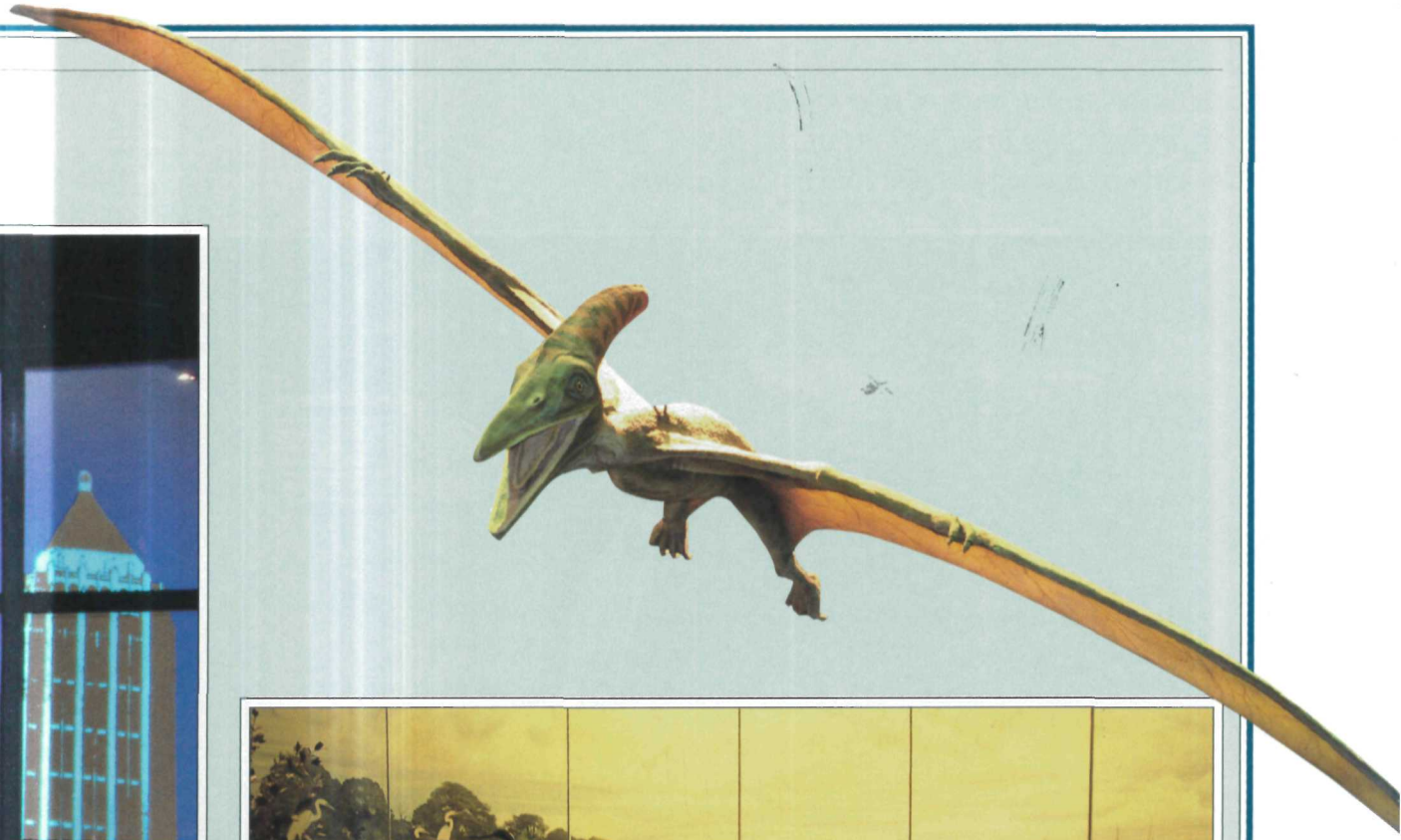


Piedmont, a buck deer pausing at a waterfall in snow-covered Cloudland Canyon in Georgia's *Cumberland Plateau*, a black bear foraging for food in the *Appalachian Mountains*, a red fox and groundhog in the wooded rocky cliffs of the *Ridge and Valley*, a wild boar rooting in the sandy soil of the *Coastal Plain*, and a summer day on a coastal *Barrier Island*.

Spring in the *Okefenokee Swamp* includes a four-minute day-night cycle filled with the sounds of swamp creatures. A boardwalk weaves through alligators, bobcats, raccoons and other wildlife. Morning songbirds yield to chirping crickets and the bellowing roar of gators.

Dr. Charles Braden, Regents' professor of physics at Tech, prepared an interactive computer simulation using two touch screens to illustrate the impact certain socio-economic decisions might have on a city. One screen is tutorial and explains how computer modeling works. The other screen permits the visitor to make a decision and see the impact of that decision 20 years later, such as how a new highway could affect the city. RIGHT: A visitor experiences sunrise on the coastal barrier isles, represented by Sapelo Island, site of a salt marsh populated by creatures such as herons and crabs.





There are 275 animals mounted in the exhibit and 1,379 artificial trees and plants, designed and created with painstaking realism of plastic fabricated from the molds of real specimens. Stanford says a tremendous number of people have been involved in creating the galleries, including museum designers, fabricators, taxidermists, chemists and biologists with the Fernbank Science Center.

Ten complementary galleries present a chronological history of the Earth, beginning with the "big bang" presentation on a 30-by-10-foot screen in the Cosmos Theater—a stunning, high-definition, laserdisc projection that incorporates dazzling computer graphics and wraparound stereo sound. Stanford wrote the narrative of the vivid computer-animated presentation of the creation of galaxies, solar systems and Earth.

"One of the aspects we emphasize is: 'How do we know?' " Stanford explains. "How do we know when we say this happened 15 billion years ago, or that the dinosaurs lived at this time? We have exhibits, films and interactive videos that try to answer the question about how we know. That often involves the physical sciences. When we talk about the Big Bang, that's the Doppler effect—that's physics. When we talk about how old rocks are, that's radio-

In touch-screen videos, two famous Georgians give brief visions of the future. "There's not another museum like this in the country."

Steven M. Gilbreath, Cls '85, a systems support specialist in Tech's computer center, wrote the program for the fossil exhibit that interacts with the touch-screen display. "That's phase one," he says. "It's the first step in a multimedia presentation." Gilbreath now is preparing a multimedia presentation to welcome visitors.

activity, and that's physics. When we tell the story of Earth and the plant and animal life that developed here, that's mostly geology, paleontology and biology.

"We have tried to explain how things got to be the way they are today."

A map features a fiber-optics display that traces the spread of humans from origins in Africa, across Europe to their arrival in Georgia about 10,000 years ago.

The final gallery gives the visitor a chance to contemplate the future. "One would think that in a museum we would try to show you what Georgia would look like 100 years from now," Stanford says. "It's nonsense. You cannot predict the future because you cannot predict scientific or technological breakthroughs."

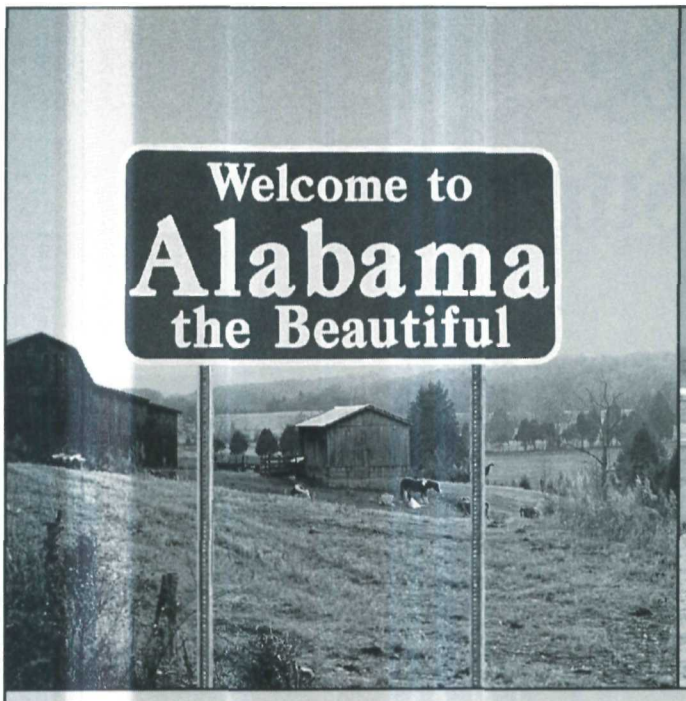
There are two touch-screen videos in which two notable Georgians—former President Jimmy Carter and cable-and-communications entrepreneur Ted Turner—give brief visions of the future.

And there is a computer simulation of a socio-economic system like a city in which a visitor can make decisions to enhance the city's future. The computer makes an analysis of the impact a decision will have on the system 20 years down the road.

"There's not another museum like this in the country," Stanford says. "It's the museum of the future." ■

Fernbank Museum of Natural History

Location: 767 Clifton Road N.E.
Telephone: (404) 378-0127.
Hours: 9 a.m.-6 p.m. Monday-Saturday; noon-6 p.m. Sunday.
Admission: $5 adults; $4 students; free to children under two (excludes IMAX theater).
IMAX Theater: $6 per film adults; $5 per film students (excludes museum tour).



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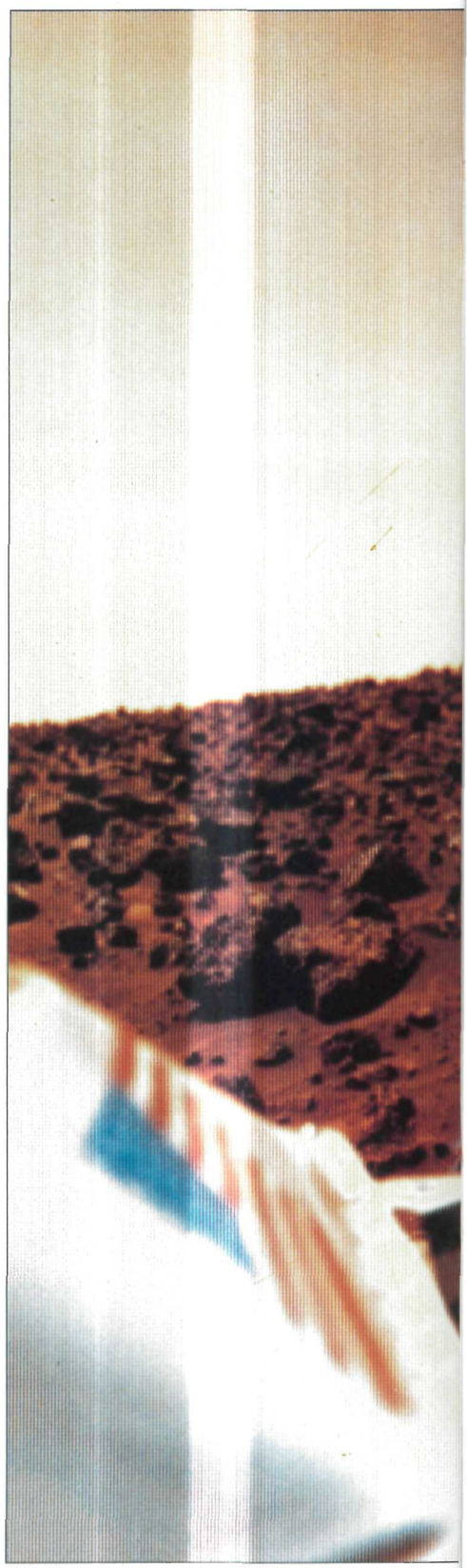
Be Sure To Take Your Dust Jacket, Buck Rogers

Mars is no place to be caught out in a storm . . . But Tech scientists are helping unlock the mysteries of the planet's weather

By John Toon



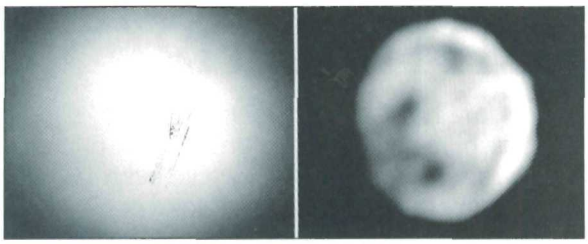
Astronomers have long been fascinated with the red planet's dust storms, which can grow from relatively small disturbances into planet-wide events capable of engulfing an area the size of the United States. Despite its proximity to Earth, scientists actually know very little about Mars' weather—especially its dust storms. Better information is crucial for planning future manned missions to Mars, and could also offer insights into concerns about Earth's climate changes.

To learn more about the unique climate, weather and geological processes of Mars, scientists from the Georgia Tech Research Institute (GTRI) and California Institute of Technology's Jet Propulsion Laboratory are working with a relatively new astronomical observing technique called speckle imaging, using a sensitive charge-coupled device (CCD) camera and data-recording system developed at Georgia Tech.

Conventional telescopes see Mars and other astronomical bodies through a blur caused by temperature fluctuations and turbulence in the Earth's atmosphere. Since the speed of light is affected by the temperature of the air through which it passes, convection and turbulence shift the incoming light waves out of phase, jumbling the details of images and causing the familiar "twinkling" of stars.

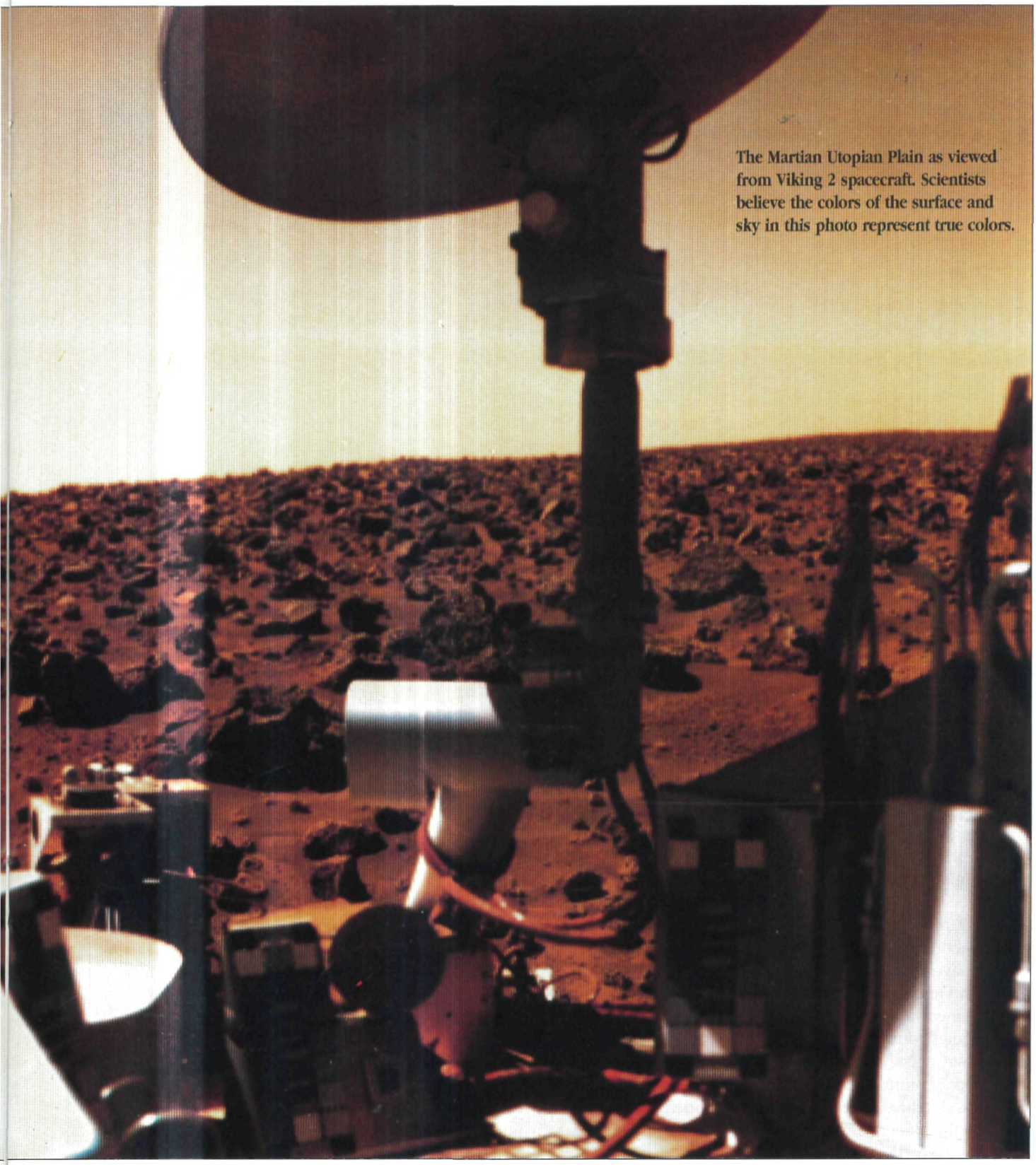
"It's the same effect you get when you look over a parking lot on a hot day," explains Dr. James Beletic, a GTRI research scientist. "You see things shimmer because the air is heated up differentially."

But by using extremely short exposure times — about 20 milliseconds—Beletic's camera can "freeze" the blurring. After a series of differently blurred images has been taken, computer algorithms sort out what stayed the same. The result is a sharper "picture" of Mars.



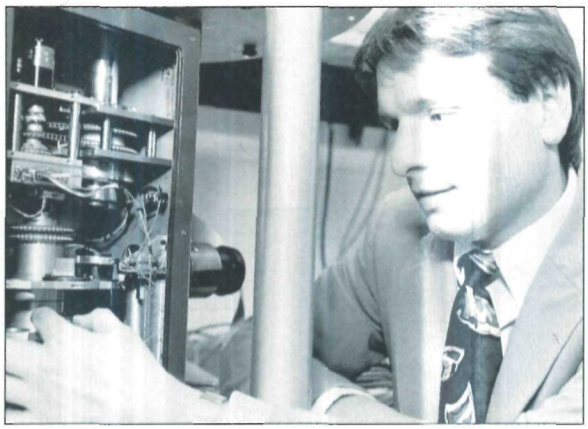
Speckle imaging (right) offers a sharper view of Mars.

"We have needed a technique that would allow us to monitor Mars even when it is at its most distant reaches," says Dr. Richard Zurek of the Jet



The Martian Utopian Plain as viewed from Viking 2 spacecraft. Scientists believe the colors of the surface and sky in this photo represent true colors.

Speckle-image analysis not only offers better understanding of Mars' weather, but also promises to unlock some of Earth's mysteries as well.



GTRI researcher James Beletic has developed a camera that can "freeze" the blurring that distorts pictures of Mars.

Propulsion Laboratory. "Speckle-imaging promises us the ability to do that."

Images produced to demonstrate the system provide enough detail to distinguish the large dust storms that are of the most concern to space scientists. The technique may ultimately show regional storms, though it will not be able to see the local storms from which they develop.

"The dust storms we are interested in cover large sections of the planet," Zurek explains.

While viewing a single speckle image might not appear to provide much information, details such as the Martian polar caps and major features emerge in the computer analysis.

After processing, says Beletic, only about one in every 10,000 photons recorded by the equipment actually contributes to the final image. The quality of that image depends on the number of frames that can be analyzed, but the faintness of the light provides the limiting factor.

"For a complicated object, you need a lot of light to get an image back," Beletic says. "There really aren't a lot of objects in space with enough light to produce a complicated image."

Except when the planet is very near Earth, conventional telescopes produce images of Mars that are little better than 1 arc-second—not enough to see much detail. The first Tech speckle images, taken in 1991 with the University of Hawaii's 88-inch telescope, provided a resolution of 0.3 arc-seconds. Beletic and his colleagues have shown that 0.1 or 0.15 arc-second resolutions can be regularly obtained.

How might dust storms affect visiting astronauts?

Spacecraft preparing to land on Mars would reduce speed by dipping into the planet's atmosphere. The resulting friction, known as aerobraking, would slow the craft and allow the Mars gravity to capture it and place it into orbit.

"To carry that out, you need to have a pretty good idea of what density to expect in the atmosphere, and at what altitude," Zurek notes. "Because the dust storms change the temperature and the temperature changes the the density, the storms can potentially affect aerobraking and aerocapture."

The gritty dust could also sandblast windows and shields on spacecraft. Because it is so fine, it could clog delicate working parts once the spacecraft is on the surface.

In addition to restricting visibility, dust storms could reduce the amount of solar energy reaching the Mars surface, and cut power generated by solar cells. And in the dry atmosphere, blowing dust could create vast amounts of electrostatic energy that could jolt delicate electronic devices, Zurek adds. "There are ways to design around it, but it would be helpful to know how often dust would be raised into the atmosphere."

But understanding these storms could do more than help prepare for a future Mars landing. The Martian atmosphere might be considered a large-scale laboratory for many of the atmospheric concerns facing Earth.

By blocking sunlight and trapping infrared radiation emitted by the surface, Martian dust storms quickly cause climate changes comparable to those scientists fear are happening more slowly on Earth. Though the changes on Mars are greatly exaggerated by the planet's unique geology and thin atmosphere, a better understanding of their workings could also show how the Greenhouse Effect or volcanic aerosols might be altering our own planet's more-complex atmosphere.

Viewing the Martian dust storms originally prompted concerns about nuclear winter, a fear that massive climate changes could result from dust and debris thrown up by a nuclear war. "Mars has shown us that raising dust into the atmosphere can significantly alter the thermal structure and circulation of the atmosphere," he explains.

More knowledge of the storms could also help scientists understand the geologic processes affecting the Martian surface. With no water to cause erosion, wind-blown dust appears to be the primary force now changing the geology of Mars.

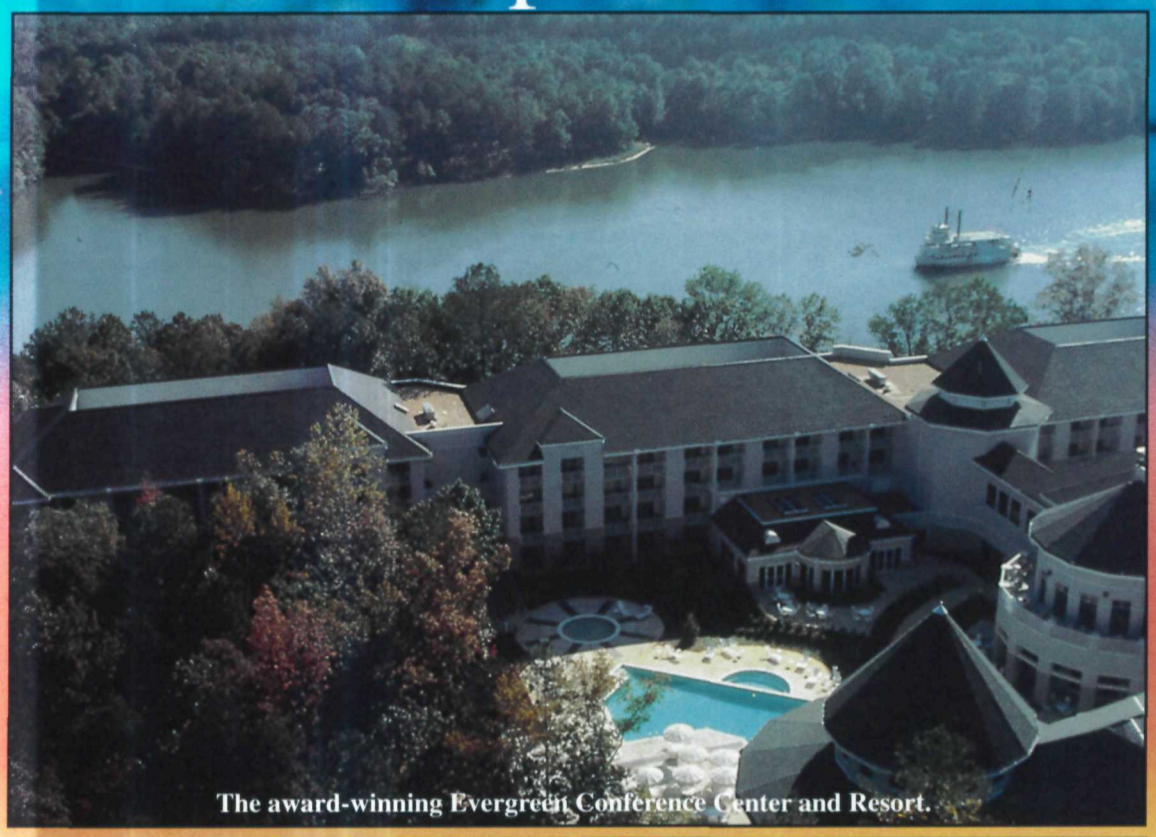
Ultimately, the institutions hope to have a telescope dedicated to regular Mars observations. A duplicate of the special camera and data recorder would be set up there. Mars images would be collected, computer-processed and transmitted to researchers.

Periodic monitoring would give early warning of developing storms, which would allow scientists to watch a giant storm develop.

Thanks to this effort, space scientists will be able to plan manned missions to Mars with more confidence. And they may one day be able to answer the question, "How's the weather on Mars today?" ■

John Toon is a writer with the Georgia Tech Research Institute.

The Simple Solution.



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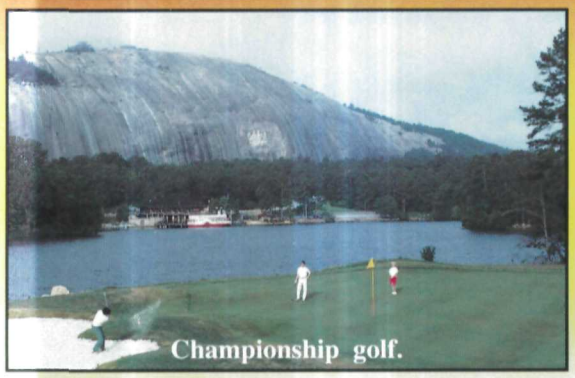

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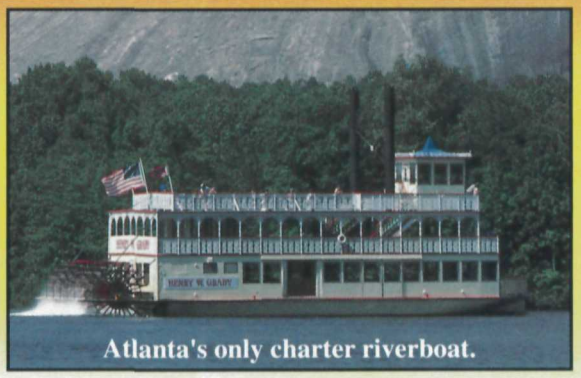

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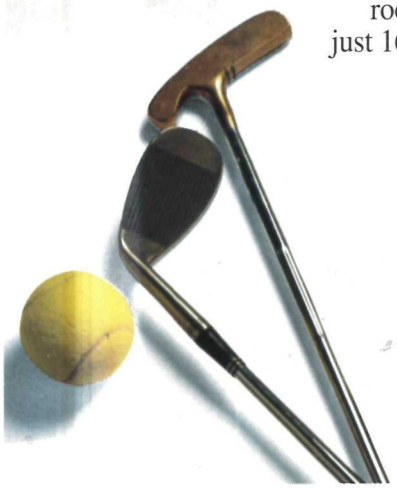

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Ron Allen's Right Stuff

Steeped in a legacy of fair treatment of employees and customer service first, Tech alumnus Ron Allen pilots Delta Air Lines into the future

By Jerry Schwartz

Perhaps Tom Wolfe didn't really find "The Right Stuff." Maybe the prototypical airline pilot isn't a spiritual descendant of a daring test pilot like Chuck Yeager—an aerial buckaroo bulldogging the clouds, cheating death on every flight.

More likely, the ideal personality for an airline pilot is closer to that of a good surgeon or lawyer—mature, unflappable, a person of solid judgment, unfailingly logical. Not spectacular, but steady.

"If you think about it, when you get on an airplane, you don't want the captain to be some silk-scarf flyboy," says Cecil G. Johnson, professor emeritus in the School of Industrial and Systems Engineering. "You want to know the man in the cockpit is emotionally stable, able bodied, and knows what he's doing."

By extension, it's also what Delta has expected of its future executives. Johnson, who has consulted at Delta for years, had that image in mind in 1963 when he recommended one of his favorite senior engineering students at Georgia Tech to Delta for a part-time, temporary job as a methods analyst.

Twenty years later, that student, Ronald W. Allen, became president of Delta Air Lines. And less than four years after that, at age 45 the Atlanta native and 1964 industrial engineering graduate was named Delta's youngest chairman and chief executive officer ever.

Now 51, Ron Allen presides over an airline which has doubled in size under his stewardship, gobbling up Western Airlines in 1987 and most of the choice assets of bankrupt Pan American World Airways in 1991. At the same time, Allen also has been the man in command during two of only four years in Delta's history when the airline has lost money. In an interview the day after Delta's annual meeting last October, Allen admitted he never expected to reach the glories and headaches of Delta's top job.

"When I came with Delta, I was a

Delta's people-oriented style of management has been passed down from the airline's days as crop dusters. "It's part of the Delta culture to this day."

temporary, part-time person. I never dreamed I would be in this job—never in my wildest expectations. But that lets me tell our people, 'If I can make it, you can make it, too.' That's opportunity in Delta that is not blocked from the outside."

Allen had reached the rank of senior vice president at Delta by the time he was 28. "I think Ron was always a little personally uncomfortable with the way he had moved, the rapidity with which the promotions had come," says Russ Heil, senior vice president of technical operations at Delta and a 1964 aerospace engineering graduate of Georgia Tech.

His meteoric rise through the Delta ranks may have been due in part to the fact that Ron Allen fit the Delta profile of a steady, level-headed corporate executive.

"Delta's senior leaders have always tried to encourage an environment of teamwork and team play. There really weren't any stars or any heroes. And certainly I think Ron fits that mold," Heil says.

Allen is flattered by others' description of him as the unpretentious, low-profile, company man. "I think it's important in this industry, a very volatile industry, that you do keep an even keel," he says simply. "I know who I am, know where I came from and I'm very proud to be where I am. But I feel a part of every job in this company."

Delta's somewhat gray, conservative image is legendary in the airline industry. As its chairman, Allen has received much less publicity than his counterparts, Robert Crandall at American Airlines, or Stephen Wolf of United Airlines—much less the superstar image of astronaut Frank Borman, who briefly led Eastern Airlines, or Borman's successor, the controversial Frank Lorenzo of Continental Airlines.

In that regard, Allen follows in the tradition of Delta's previous chief executives, men who carefully tended Delta's corporate culture and bottom line with little regard to personal image. It allowed Delta to develop a much-envied reputation as a company with one of the best management-employee relationships in any industry. According to Johnson, that dates back to the company's founding in 1924 as a crop-dusting operation in Monroe, La.

"The founder was a man named C. E. Woolman, whose background was as a county agent," Johnson says. "He knew the charm that it takes to deal with farmers. If you're going to bring new ideas and new technology to a farmer, you've got to have a lot of 'good-people skills.' And that's something that persists in the Delta culture to this day."

Ron Allen agrees that Delta's ability to deal with people is a hallmark of its management style. But, he says, that idea didn't come naturally to him. His early mentor at Delta, W. T. "Tom" Beebe, schooled him in Delta's management style. Beebe, then head of personnel and later chairman of Delta, encouraged Allen to move from the methods and engineering side of Delta into personnel. Allen was reluctant. And that was only natural, according to Johnson.

"The first and second generation of top management in Delta were people who had a great deal of experience with people, not school experience. Starting with Tom Beebe and continuing to Ron, the managers have been people with more formal education. They had to learn the Delta culture, the common-sense things. They already came to Delta with the analytical textbook stuff," Johnson says.

"I wasn't sure personnel was what I ought to be doing," Allen admits. "But I said I would try it. And I found out that personnel is where the action is in this company.

"As an industrial engineer, I was trained to go out and design man-machine systems and then find the perfect individual to kind of fit into the job. I found out it doesn't work like that in the real world.

"One day we were dealing with a situation in one of our offices involving some of our people and Tom said, 'Here's how the textbooks teach this, but this is how it is here at Delta.' The difference was you didn't design the job first. You put the people first," Allen says.

Delta strives to make service to each passenger one of the hallmarks of its business. "It's simply attention to the individual. You can call it Southern hospitality, and I know the media has used that term about us, but it's just treating people right."

In fact, Allen recalls, a group of skeptical New York news reporters asked him whether a tradition of Southern hospitality could be imposed on the cattle car of the airline industry—the Boston-New York-Washington shuttle—after Delta bought the shuttle from Pan Am.

"Of course, we were going to maintain the Delta level of service. To give you an example, if you've ridden the shuttle, you know you deplane through the rear door. Well, a lot of grease and oil from the engines collects around that rubber seal on the rear door. You'd get off the shuttle and think how dirty it was. So since we started flying the shuttle we've got our people taking a dry

DELTA AIR LINES PHOTO

mop and cleaning off that seal every flight.

"Those are some of the characteristics that we want to maintain. We want to present a service image to our customers that's just like the service image we presented in 1929, when we started serving passengers. That's the difference in Delta Air Lines. It's not a regional difference. It's what people respond to."

Still, Allen bristles at the suggestion that the Southern airline might be a bit slow-footed, as well. "We may not be thought of sometime as a slick, go-go company, but I'll assure you we are as go-go as any airline in this business."

"Delta has a conservative reputation, but what they really do is to move very stealthily," said Kevin Murphy, the airline analyst at Morgan Stanley & Co. "They are not a company that will sit dead in the water. They take a strong, silent approach."

The acquisition of both Western Air Lines and Pan Am assets surprised many analysts. But Allen says the acquisitions were not only smart business, but absolutely necessary.

"The growth was fast, but we had to move fast. It was important that we move, and not be put at a competitive disadvantage. And we were developing situations where we could have been put at a competitive disadvantage. With other carriers establishing gateways out of the Northeast to Europe, if we had not made the Pan Am deal, we could have been at a disadvantage. We turned that into a real advantage for Delta.

Delta CEO Ron Allen on the flight line: The company may not have the "slick" reputation, but "I'll assure you we are as go-go as any airline in this business." Evidence of Allen's vision can be found in Delta's expansion into new markets.

"We're going to do what must be done to bring Delta back to profitability."

"We had a major void out West. We looked at different hub locations to complement what we'd done, for example, in Dallas-Fort Worth and Cincinnati and Atlanta. We needed that Western hub. We looked at every city from Phoenix to Denver to Las Vegas. Salt Lake City kept coming up as the best geographic location and Western had a hub there. It was a natural marriage, absolutely natural marriage. I would say, 'No, we didn't make the wrong move.' "

Nevertheless, stockholders and airline analysts have begun to question Delta's management more closely since the airline, in common with all major U.S. air carriers, began reporting major losses in 1991. For the year that ended last June 30, Delta reported a net loss of $506.3 million. And in the first quarter of its new year, Delta lost $162.5 million. Even though Delta's revenue rose during the quarter by 17 percent over the same quarter in 1991, the company's costs rose by 27 percent. The all-important cost-per-available seat-mile rose from 8.94 cents in 1991 to 9.46 cents in 1992.

Allen and executives at the other airlines attributed much of 1992's rises in costs and net losses to a summer fare war. Prices were cut in half and stampeding passengers nearly overwhelmed all of the airlines' systems, from reservations to baggage handling.

"If you go in and cut your prices in half, you fill up your airplanes, but your break-even is very high, your people are working hard, your regular business travelers are frustrated because they don't feel like they're getting the service that they deserve," Allen says. "Everybody is working very hard and you're not making any money. And that's a bad deal, a bad deal.

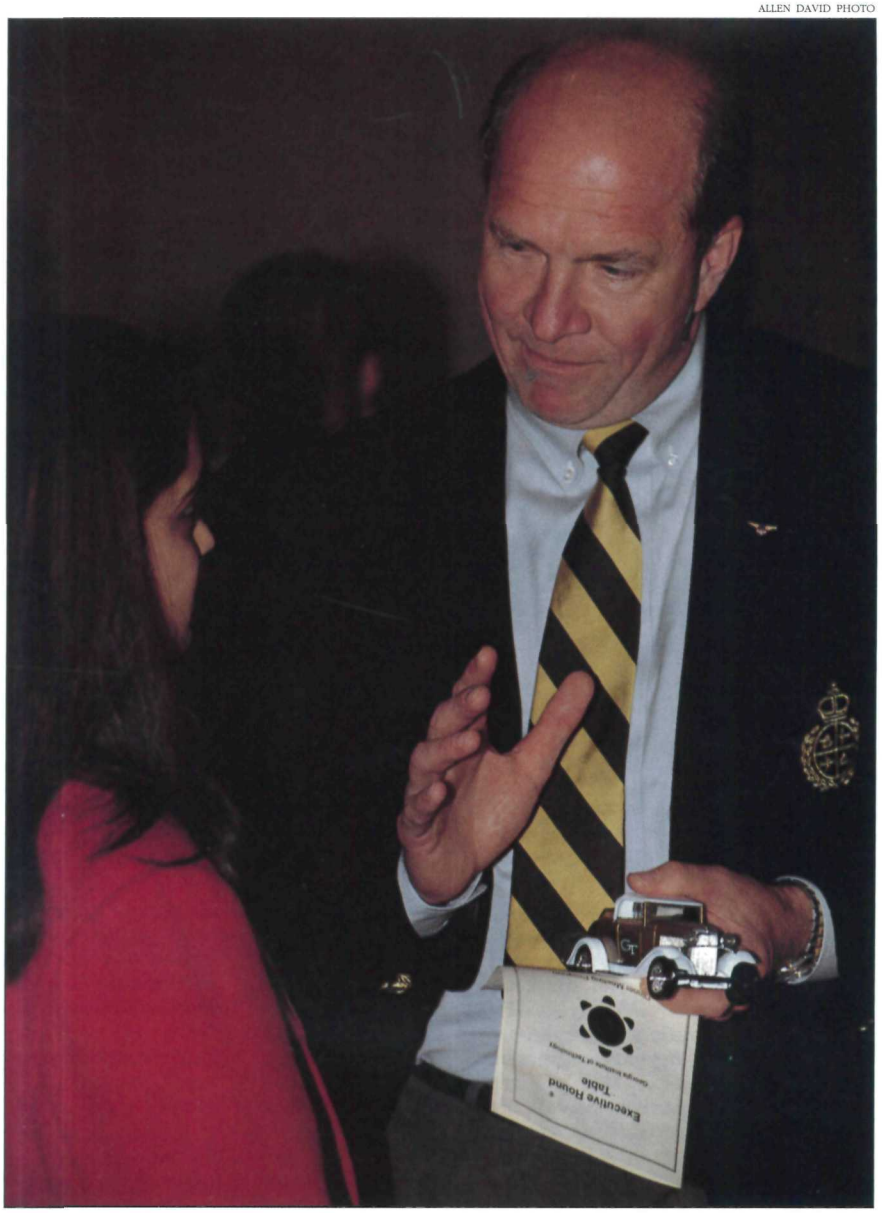
"We must get our costs down, but at the same time we've got to avoid some of the crazy things that were done in fares this past summer that don't make any sense."

Allen is not about to panic and kick hard at Delta's rudder. "We're going to do what must be done to bring Delta back to profitability, but in doing so we don't want to tear up the fabric. We've got the right formula. We do not need to change the formula. We're going back to the basics and really work on our costs—enhancing our service, enhancing our revenue. But we don't want to change our basic approach. A lot of companies that go through dramatic change make some mistakes in that regard. They lose the basic characteristics that set them apart. And we don't want to do that at Delta. We absolutely won't do that."

Even if Delta is resisting basic changes, the airline industry has changed and those who know Ron Allen say he has changed with it.

"There is a business environment

ALLEN DAVID PHOTO



Allen recently explained the intricacies of the airline industry to Korina Zaveri and other students at an Executive Round Table session on the Tech campus.
LEFT: A Delta plane readies for takeoff at Atlanta's Hartsfield International Airport.

MARK SANDLIN PHOTO

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OFFICIAL SPONSOR ALUMNI MAGAZINE

JOHNSON YOKOGAWA

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The difficulties Delta has experienced can make Delta a better company, believes Allen. "I feel the Delta family is stronger than ever before."

that's much less stable than it was 20 years ago," says Russ Heil.

"Twenty years ago we were a regulated business and change tended to occur rather slowly. That's not the situation today. Not only is the change very rapid, but we also have much less control over the conditions that affect us. Ron has recognized that, since he moved into the chairmanship. Because of the change in the environment, it's been necessary for him to be more proactive in the public arena than was felt necessary by past Delta leaders."

Not only has Allen moved into the foreground of media attention, but he's also been a visible symbol of involved corporate management for the company's 80,000 employees. By the time of last October's annual shareholder's meeting, the Delta chairman had been on the road, meeting with Delta employees for 11 of the preceding 12 weeks.

"One of the keys to getting our costs under control is to communicate with our people," Allen says. "That's why I've been traveling so much. We've been telling our people more about Delta's cost problems, the problems of not being able to generate the revenues because of the fare situation, and the need for profitability. We've been out communicating that more openly than ever before."

The response, Allen says, has been overwhelmingly supportive. Last summer the airline opened an old-fashioned suggestion box. By late October, Allen said, 5,710 employees had submitted 12,884 ideas that already have resulted in $24.64 million in savings. As an example of a seemingly trivial suggestion that meant big dollars, Allen cites a decorative lettuce-leaf liner put on meal trays. "Nobody ever eats it. It always ends up on the plate back in the galley." What shocked Delta executives was that the company could save $1.4 million a year by eliminating the decorative lettuce leaf.

MARK SANDLIN PHOTO

As Delta's chairman, Allen has been in the air almost as much as his planes. In his efforts to talk to many of the airline's 80,000 employees, he travels much of the time.

The most difficult test of Allen's well-honed skills for managing people has appeared to come from his battle with the leaders of Delta's only significant union, the Air Line Pilots Association (ALPA). "The leadership of the pilots' union is not on board with us. They're way out of touch.

"Our Delta pilots are on board with us. I've been to a lot of the pilot meetings myself. They have a lot of tough questions. Needless to say, they should have. They're very responsible. They're the finest pilot group in the industry and absolutely loyal. I have total confidence in our pilots. They're out to save us money on every flight. The frustrating thing for us right now is that the union leadership is playing a typical union game, and doing so hoping that if they don't respond, the problem will go away."

Notwithstanding the problems, Allen says he is confident about the future of his company. "We are seeing the results of our efforts. I think the trends are beginning to improve for us. I see a little light at the end of the tunnel. I would not speculate on when we would return to profitability, but I am encouraged."

The difficulties Delta has experienced, he says, can make Delta a better company.

"I feel the Delta family is stronger than ever before. We're going through the most difficult time we've ever gone through. But our people want so much to protect this Delta family that they'll fight for it. So we're optimists at Delta. We never lose our optimism." ■

Jerry Schwartz is an Atlanta freelance writer.

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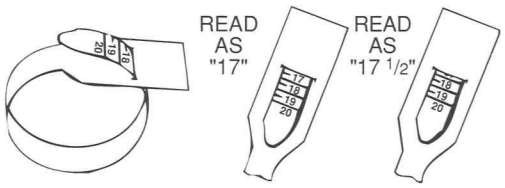

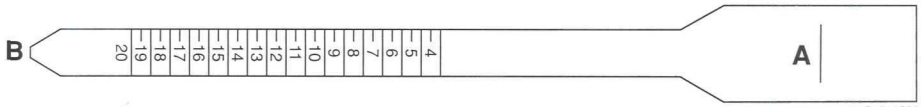

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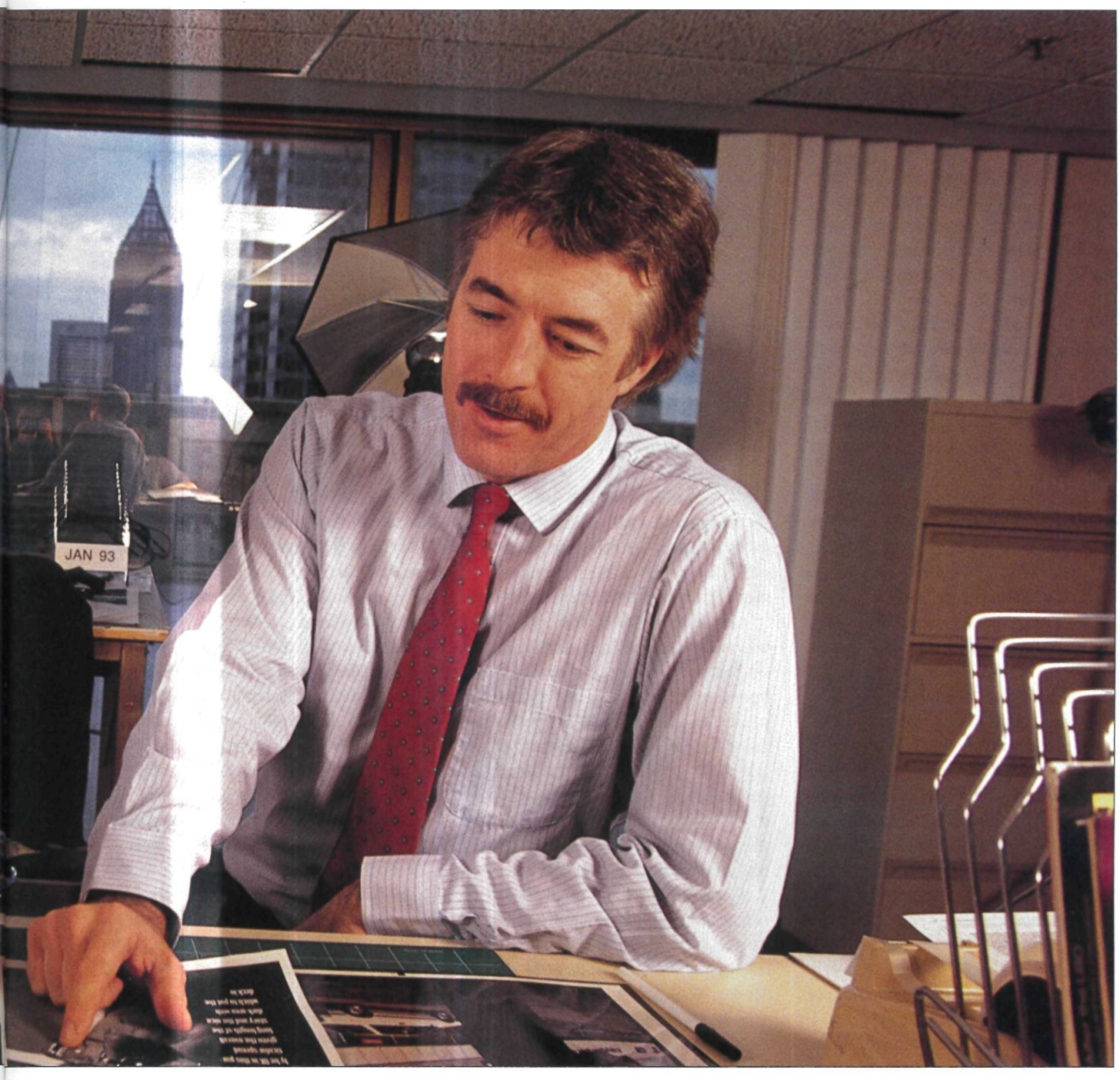
Winning Strategy

By B. Eugene Griessman • Photography by Billy Howard



Since his student days at Georgia Tech, Virgil R. Williams has exhibited an entrepreneurial style and a competitive nature that has produced success. "I like to compete and win," he says. In whatever field—business, banking or politics—Williams has been a winner.

• Williams is chairman of Williams Service Group, an Atlanta-based diversified engineering-services company with approximately 1,100 employees and offices in Philadelphia, Chicago, New Orleans, Chattanooga, Birmingham and Auburn, Ala.

• Williams introduced banking in Kroger grocery stores in Georgia, and is the leading stockholder of Bank South.

As in his other ventures, Virgil Williams (*left*) plans to turn *Georgia Trend* magazine into the "premier statewide business magazine." He plots strategy with editor Ed Bean (*above*).

Believing he can be successful in magazine publishing, without prior experience, is a vintage Williams attitude—like not being intimidated by anybody or anything.

• Williams chaired Georgia Gov. Zell Miller's election campaign, serves as the governor's chief of staff, and headed the governor's Commission on Effectiveness and Economy in Government.

Now Williams has taken on a new challenge—publisher of *Georgia Trend* magazine, purchased this past September. Williams intends to blend business and politics in the publication. His model is *Forbes* and his stated goal is to publish the "premier statewide business magazine in the country."

For Williams, setting such goals is the confident outgrowth of a lifetime of determination, foresight and business acumen. By the time he received his degree in industrial engineering in 1963, Williams was well on his way to becoming a seasoned entrepreneur. With his wife, Sara, whom he had married during his sophomore year, he started a construction business. The first year he built three houses, the next, he constructed 10 houses; during his senior year he oversaw the completion of a 40-lot subdivision, a service station and a 12-unit apartment project.

Williams somehow managed all that in addition to helping with the painting company and the swimming pool manufacturing company that his brother, Jim, was running. He didn't think of his activities as being anything unusual because his father, brother, uncles and cousins were in similar businesses. The owners of Williams Brothers Lumber and Concrete were his cousins.

"It wasn't a foreign enterprise," he remembers. "I was doing something that the family was doing. Fortunately, I didn't need to lean on them because I was doing it on my own."

Had anyone noticed, they could have detected a pattern that has characterized Virgil Williams throughout his career: a close association with family members and the ability to successfully manage more than one task at a time.

Friends say those are characteristics of the entire Williams family. It was true of Virgil's father, Jim Williams Sr.—Mercer Williams, as he was called. And it has been true of Virgil's older brother, Jim, who graduated from Georgia Tech with a degree in chemical engineering in 1953. Jim and Virgil have worked on so many projects together that is is misleading to credit one without the other for many of the accomplishments the brothers have achieved.

During the 1950s, Williams' father, who was a successful painting contractor, saw an opportunity. At the time there were not many swimming pools in the southeast. When Williams learned of an opportunity to purchase a franchise to manufacture swimming-pool equipment, he took it. He subsequently formed two new companies: Poolquip, and Atlas Manufacturing and Machine.

Construction was begun on an office building to house the companies in Chamblee, but after only six months of operation, tragedy struck. Mercer Williams was stricken with a fatal heart attack and the two young brothers were left to run the fledgling businesses. It was a traumatic experience for 19-year-old Virgil, who was very close to his dad.

The brothers decided that Virgil would finish at Tech and that Jim, seven years Virgil's senior, would run the businesses. Virgil agreed to help out part-time.

At Tech, Virgil focused on what he was convinced he would someday need—on "practical" electives, whenever he could. He signed up for surveying in civil engineering, even though he was in industrial engineering. "I took accounting, which was an elective. I still remember those mathematical things I learned—even those English things I learned. I wish I had learned about finance and marketing and economics. Those are the three most important things I use now. As an engineer, I didn't learn much of that in school. Practically all of my marketing knowledge is self-taught. If I could do anything I wanted to, and it would work out with my lifestyle, I would go back and get a master's from Harvard or Wharton, and focus on those three things."

The fact that he wanted to learn more doesn't indicate that he is insecure. "I'm not intimidated by anybody," he states.

That kind of assurance is born of successfully getting through a demanding educational experience like Tech's. It also comes from solid accomplishments. In recent years, Williams has been cast into the spotlight as chief fund raiser and campaign manager for Gov. Zell Miller and subsequently as the governor's chief of staff. And his acquisition of *Georgia Trend* magazine has drawn even more attention and speculation about his long-range plans.

The early years after graduation were spent developing, refining, and expanding the core Williams businesses. During the 1960s and 1970s Williams Contracting was busy doing commercial and government painting contracts. Poolquip, headed by brother Jim, was designing and manufacturing swimming pool equipment, including the first fiberglass diving board and filter, and the first fiberglass pressurized filter tank.

In 1973, Virgil and Jim took on an unusual project—designing and building the Great American Scream Machine at Six Flags Over Georgia. Their plans deviated from standard roller-coaster construction in that the roller coaster was prefabricated in

Williams has been a friend of Gov. Zell Miller (*left*) since the late 1970s. He chaired Miller's campaign and now serves as the governor's chief of staff.

the shop instead of field measuring, cutting, erecting and painting each piece on-site. They completed it profitably and ahead of schedule.

About that time Williams Contracting entered the nuclear-power field, with a big contract to recoat the containment dome at Florida Power and Light's Turkey Point Nuclear Facility. Virgil decided to become expert in the field, and earned certification for work in nuclear facilities—the third person in the nation to become so certified.

During the 1980s, the Williams brothers began to buy and sell companies in earnest, some quite different from their core businesses. Journalists began to refer to "the Williams Conglomerate." In 1980 they acquired the Gwinnett County Bank and the Fulton County Bank, and consolidated them under the name Heritage Bank. When they struck a deal to open branch banks in Kroger supermarkets—the first supermarket banks in Atlanta—and kept them open from 8 a.m. to 8 p.m., assets grew from $23 million to over $300 million. That transaction made Virgil Williams the chief shareholder of Bank South.

They decided to capitalize on their banking experience and formed International Banking Technologies Inc. in 1985 to provide banking expertise to retailers and financial institutions across the country and overseas.

Meanwhile, the Williams brothers were moving on other fronts. They formed Williams-Adair Equity Corp., a limited-partnership real-estate investment company. They became affiliated with the civil engineering firm of Moreland Altobelli Associates. They formed Williams Mechanical to provide mechanical maintenance services, and acquired Pulpco to rebuild projects for the pulp and paper industry. They bought Offshore Painting Contractors to handle requirements for the offshore petroleum industry, and Shaw Insulation Service for insulation requirements. In 1986 they founded Azcon to specialize in the control of asbestos materials. They purchased Harmon Engineering Associates to deal with environmental problems and hazardous-waste remediation. Subsequently all the companies and divisions became known as the Williams Group, with four divisions: Williams Service Group, of which Virgil Williams is CEO; Environmental Services Group; the Real Estate Group; and the Financial Services Group.

Virgil Williams, who bears a physical resemblance to Zell Miller, has been a friend of the governor since the late 1970s. In 1988 Williams agreed to chair Miller's campaign for governor. When Miller was elected in 1990, Williams was named his chief of staff and placed in charge of the Commission on Effectiveness and Economy in Government.

Georgia Trend, which Williams acquired recently, is his first venture into the communications business—but it probably will not be his last. He's already applied for a three-digit phone number, which previously was available only to phone companies and are now being bought by several media giants.

Williams believes he can make a lot of money in the media. "Do I have to tell you about Miss Anne Cox Chambers and the kind of house she lives in?" Williams recently asked *Atlanta Journal and Constitution* writer Cynthia Mitchell. "If Miss Chambers can make a lot of money at it, maybe I can. Or if Ted Turner can make a lot of money at it, maybe I can."

That's a vintage Williams attitude—like not being intimidated by anybody or anything, or considering Ted Turner or Anne Cox Chambers as peers, or seeing what somebody else is doing, tweaking it, and making money at it. ■

B. Eugene Griessman, PhD, is author of the award-winning book, The Achievement Factors, *and host of the syndicated radio feature, "The Achievement Digest." He is writing a book on diversity in American society.*

For a look at Williams' philosophy on business, politics, education and aspects of success, see next page.

Virgil Williams

"If you're determined, work hard and resign yourself to succeed, you will."

In the almost 30 years since Virgil Williams graduated from Georgia Tech, he has succeeded in a variety of business ventures and reached the top echelon of state government.

How does he do it? Williams says he enjoys creating, innovating and competing. "I'm very competitive."

Williams discusses his philosophy on business, politics, education, and aspects of his success.

Politics and Government

Most business interfaces with politics sooner or later, sometimes in major ways. In some instances, a business' success is totally controlled by politics and government.

I wish there were more graduates of Tech who understood the political system so that Tech would be treated on a politically equal basis in Georgia. Unfortunately, there are few Tech graduates in the legislature and in political positions because we don't generally graduate politically oriented individuals. The school has to stand on its own without a lot of supporters. I'm not jealous of the University of Georgia. I just wish Tech had equality in that sense, and it doesn't. I know where most of the influence is in the legislature and in the government, and not much of it is oriented toward Tech.

A Good Business Person

A good business person has to be very perceptive . . . to see beyond the obvious . . . to be creative. He has to have a marketing flair, and be able to differentiate himself from what other people are doing.

I'm a contrarian. I try to look at what somebody else has done and say, "What can I do differently?" That doesn't mean that I don't copy. I'm a great copier of ideas. If I see an idea, what I want to do is take it and improve upon it. If I see something that's working, I'll tweak it and try to make it better.

Goal-Setting

I have goals, but they're generalized. My goals are not "I'm going to reach X, Y, Z by such-and-such a date." We have a business plan and objectives for various units. That's important, but not *very* important.

I believe absolutely in serendipitous discovery. Something could happen this afternoon that would change the whole direction I'm going. I bought my first bank in one day. I just liked the smell of it. I trusted my instincts. It was a $23 million bank. I hadn't had any experience in banking—except borrowing money and having a checking account.

Owning a Magazine

The reason I bought *Georgia Trend?* To be completely honest, down deep it's the ability to control and have power over what's in that magazine—I'd like to have a positive effect on the outcome of events, and I think I can do this by being able to control the ink.

Managing Many Businesses

The most important thing is selecting the right management. I didn't understand a lot about banking when I first got in. But I never had a concern about it because I knew there was a big resource pool out there that I could grab if I ever had a difficulty.

In every business I've ever been in, I've had the self-confidence that I could roll up my sleeves and with a few people make it happen.

The Talent Search

I look seriously at loyalty. Creativity. I know it when I see it, but I can't always describe it. I look for energetic people—people who are a little bit like myself, but people who can stay in the trenches. I can't stay in the trenches very well. I look for people who have some of my attributes, where the chemistry is good, so that when I talk about things, they understand it.

What Georgia Tech Teaches

Persistence. The desire to succeed—to get through that class, to pass that physics test. Determination. It was like a baptism by fire when I went to Tech. It wasn't easy. I had to struggle and work hard—I learned a lot from that. Many a time I was about ready to give up. I learned that if you're determined and work hard and resign yourself to succeed, you will. I learned how to study, how to concentrate, how to keep myself focused when I had to be.

The education I got at Tech has helped me millions of times in dealing on an equal basis or a superior basis with the people surrounding me.

It is important for my own peace of mind that I am a peer with the best. I'm not intimidated by anyone. I often think that I went to as good a school as there is anywhere, and passed it and succeeded.

I doubt if I could get into Tech today. I've wondered, what if I had come along in the '90s, when Tech's SAT is well over 1,200, and I weren't accepted? It would have changed my entire life.

Georgia Tech doesn't need to raise its standards so high that Georgia boys and girls who just haven't reached the maturity level or maybe need to work harder to succeed, can't go there. I've thought a lot about that. If the student gets in and can't keep up, that's a different matter. But you'd be surprised at people's resourcefulness if they're determined. I know, I was that way.

—B. Eugene Griessman

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Two-Mantle Earth

Georgia Tech researchers have found evidence that the Earth has two mantles —a theory that could add insight into deep earthquakes, certain volcanic activity, and even the formation and evolution of the planet.

New evidence that the Earth's mantle consists of two distinct layers containing different proportions of key mineral components addresses a central issue in geophysics about the evolution of the planet.

The mantle is the middle layer of the Earth's interior, located above the core and below the thin crust on which the planet's surface features lie. It is a layer of extremely hot, pressurized material which extends from about 100 kilometers to approximately 2,900 kilometers below the surface.

The existence of two layers in the mantle—by volume the largest region of the Earth's interior—would have slowed cooling of the planet after its formation, affecting theories about how the Earth evolved.

The differences between the upper mantle and lower mantle could also help account for certain deep earthquakes that cannot be adequately explained by conventional earthquake theories.

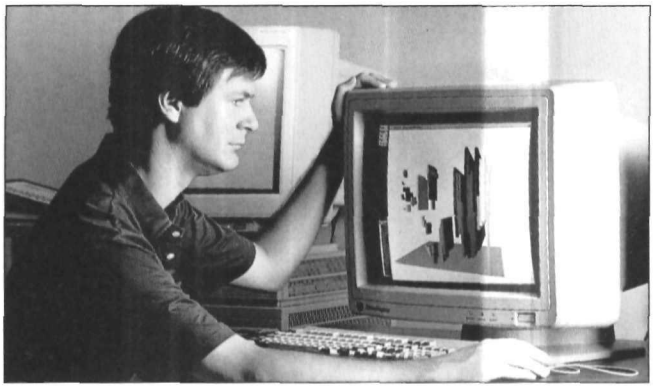
"When earthquakes happen, they send out seismic waves that travel through the mantle and give us information about the elastic properties of the earth's interior," says Dr. Lars Stixrude, an assistant professor in the School of Earth and Atmospheric Sciences. "We can measure minerals that we believe exist in the mantle and compare their elastic properties to the ones we measure from the Earth through seismology."

Analysis of seismic wave information shows a "discontinuity" located about 670 kilometers below the surface. This boundary may represent a change in the phase at which the materials exist, or both a phase change and a change in the chemical composition of the materials there.

Proof of the theory must await more sophisticated analysis of seismic data at subduction zones—areas where the massive plates which make up the ocean floor plunge downward into the mantle. Because they are cooler than the surrounding mantle, those plates should affect the boundary between the upper and lower mantle, pushing it deeper.

How did the two layers originate?

Stixrude speculates that while the mantle area remained molten during formation of the Earth, crystals of denser materials may have sunk into what is now the lower mantle, while lighter materials floated above it into what is now the crust.



In Tech's new GVU Center, Dr. John Stasko displays a visual that helps users understand the operation of computer algorithms.

User-Intimate Computers

Georgia Tech has established a Graphics, Visualization & Usability (GVU) Center to help make computers more user-friendly through advances in computer graphics and information visualization.

The declining cost of computer hardware and increased access to software have broken down the technological barriers that prevented widespread use of computers. But before computers become as widely and effectively used as telephones, better methods must be developed to help humans and computers communicate with each other, says Dr. James D. Foley, director of the GVU Center.

The GVU Center will focus interdisciplinary efforts on the issues of graphics, visualization and usability by bringing together 25 faculty and researchers—along with nearly 100 graduate students—from 10 different Georgia Tech colleges, schools and offices.

The center's mission includes teaching, research and service.

The GVU Center operates a 3,000-square-foot research facility and scientific visualization laboratory housed in Georgia Tech's College of Computing. Included in the facility are a usability laboratory for studying user-computer interfaces, a complete video-editing studio, and more than 45 Apple, DEC, Silicon Graphics and Sun workstations. ■

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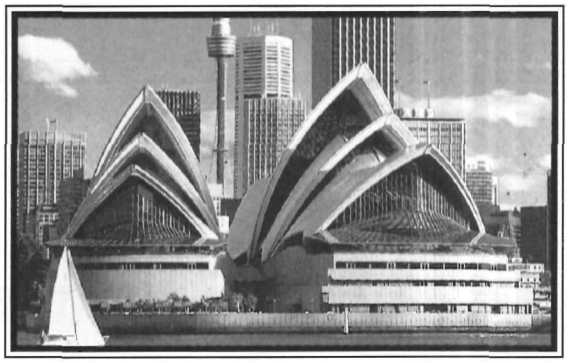

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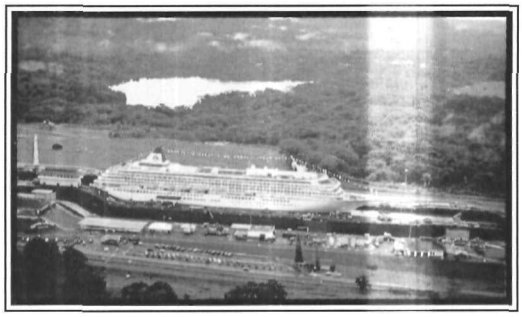

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Opportunity for Change

By John Carroll

After a 34-year banking career, D. Raymond Riddle, one of the state's banking giants as president and CEO of Wachovia Bank of Georgia, has taken his common-sense, conservative business style to lead the *Fortune* 500 firm, National Service Industries.

The 59-year-old Riddle became president and CEO of NSI on Jan. 1. A 1955 industrial management graduate of Tech, Riddle called his career change "an outstanding opportunity for me to do something totally different from anything I've ever done before."

NSI is a diversified manufacturing and service company with annual revenues of more than $1.6 billion and 20,000 employees. The conglomerate has operations in six industries: lighting equipment, uniform rentals, specialty chemicals, envelopes, insulation and marketing services. The scope of NSI's operations extends to all 50 states, Canada and Western Europe.

Riddle, who said his obvious objective at NSI is "to maximize shareholders' value over time," added that he also feels a strong commitment to the firm's huge work force.

MARGARET BARRETT

Banking giant and Tech grad Raymond Riddle seeks new challeges with a job-change to NSI. His first two concerns: "maximize shareholders' value" and a commitment to the firm's work force.

Riddle said he will "constantly rethink our strategy and direction. You do that by having smart people around you, and sharing their ideas.

"The great thing about this company is that it has very good cash flow and very little debt," he says.

At the end of fiscal 1992, NSI's cash reserve was $110 million and its long-term debt was only 7.7 percent of total capitalization. "This allows the company to be anything it wants to be."

Riddle says he will make decisions at NSI the same way he made them at Wachovia: conservatively. "Both companies are methodical about assessing risk, and understanding what the plusses and minuses of a transaction are," he says. "From that standpoint, I don't expect any differences in the way I might look at opportunity."

One intangible element of NSI that Riddle plans to evaluate is the company's culture. "Culture is the way things are done. The way you communicate internally—the subtleties of interaction. You can only find out how culture works when you are actually a part of the process."

Riddle stresses the importance of communicating with people, identifying individual weaknesses, and recognizing mistakes.

"Good people" and "honest management dialogue" are keys to success

"I have found that in managing a business, when you make a mistake, it's important to recognize that mistake, and change your course of action," he says.

"You have to know what your skills are," he adds. "I find those things that I don't do well, and then put someone close to me that knows how to handle those problems. If you want to be the best, then that requires you use all other people's talents that you can find. That's the way I approach this opportunity at NSI.

"It's critical to create a business atmosphere where everyone knows their part on the team, and how much you depend on them. If you surround yourself with good people and you have a level playing field with an honest management dialogue, the people will motivate themselves."

Riddle said his experience at Georgia Tech helped prepare him for the business world. "I learned how to get along with all walks of life, from highly-intelligent, scientific-type people to good ol' playboys who stayed out all night."

Riddle is a director for eight institutions and a trustee for 10 others, including the Georgia Tech Foundation and the Georgia Research Alliance.

Riddle is also chair of the Human Resources Committee for the Atlanta Committee for the Olympic Games, and oversees all employee hiring and compensation policies for the 1996 Games. "The Olympics will give people in the community a great way to express themselves to the world," he says.

Riddle says he feels no pressure about becoming the president and CEO of one of the largest industrial corporations in the world.

"It's only pressure when you don't know how to deal with it," Riddle says. During his longtime career in banking—including being at the helm of First Atlanta when it was purchased by Wachovia Corp. and roller-coaster economic times—Raymond Riddle has learned to deal with pressure. ■

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

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Artistic Architecture

GARY MEEK PHOTOS

The ranks of Georgia Tech graduates include a growing number of architects who are combining the technology and principles of their profession with art, giving form to ideas and creating structures that are not only functional, but expressive.

The Hulse house (*right*) was designed in 1985 by Anthony Ames, Arch '68, for a young couple interested in a modern interpretation of residential living in Atlanta's Ansley Park. The modern house was built on the site of an older dwelling that was demolished.

"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," says Ames. "The double-height living room and the master bedroom provide views of the park across the street.

"The crisp geometric forms and monochromatic treatment contrast with and emphasize the lush natural surroundings."

Ames' other projects include the Atlanta Botanical Gardens and the Fulton County Library Alpharetta branch.

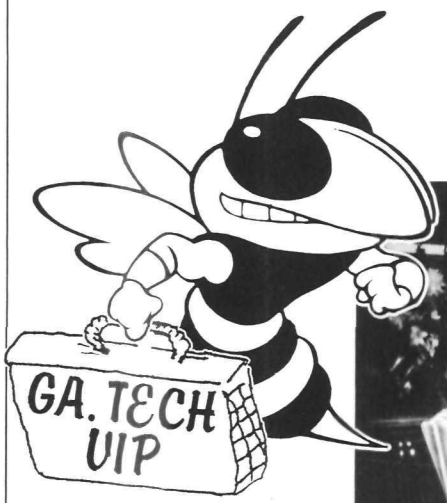
The current incarnation of the Trinity School (*below*) was completed in 1987 by Larry Lord, Arch '65, and the firm of Lord Aeck & Sargent. Housing pre-schoolers through sixth-graders, the old building had a "typical school look—brick with strip windows and a flat roof," says Lord.

The firm's task was to re-make the structure, maintaining its functionality while imparting a signature style. Out of that design process emerged a style that Lord calls "kindergothic."

The firm's other projects include the Manufacturing Research Center at Tech, and the renovation and expansion of the Woodruff Research Building at the Emory medical school.

Trinity School was misidentified as Hulse House in the fall issue of the GEORGIA TECH ALUMNI MAGAZINE. ■

A Brief Case For Your Business.



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Optimal Efficiency

By Michael Pousner

Dr. George L. Nemhauser, a casually dressed slender man in aviator glasses, has interests beyond his speciality in combinational optimization. He dedicated his book, *Integer Programming*, to the New York Knicks basketball team. And the dust-cover photo shows him shooting baskets. Like Tech's head basketball coach Bobby Cremins, Nemhauser is a native of New York City's Bronx.

Nemhauser's odyssey from the streets of the Bronx to the corridors of Georgia Tech has been an adventuresome one. He received his bachelor's degree in chemical engineering from City College in New York, and earned master's and PhD degrees at Northwestern University. Professor Jack Mitten, his mentor at Northwestern, convinced him to drop his idea of getting his doctorate in chemical engineering and, instead, to study operations research.

Nemhauser spent four years in Belgium, where he was research director for the Center of Operations Research and Econometrics at the University of Louvain, because he felt the experience would further his knowledge of the world.

Among the people he most admires is Dr. Jacques Dreze, a Belgian economist who greatly influenced him. Dreze, who retired from academia recently, then sailed around the world with his wife and one of his sons in a small boat. "He had a vision I like," Nemhauser says. "He's a lively guy and a risk taker."

Nemhauser is also lively. Highly animated and quick to smile, he talks of his life's work with great pleasure. "My basic research over my career has been in developing methodology for doing optimization problems and looking at real-world applications," he says, noting with satisfaction that in the process, his field grew from dull time-and-motion studies into a sophisticated discipline all its own. It led to the creation of the Center for Computational Optimization on the fourth floor of the Groseclose Building and, eventually, to his selection as an Institute professor—one of many honors Nemhauser has received, but one of which he is particularly proud.

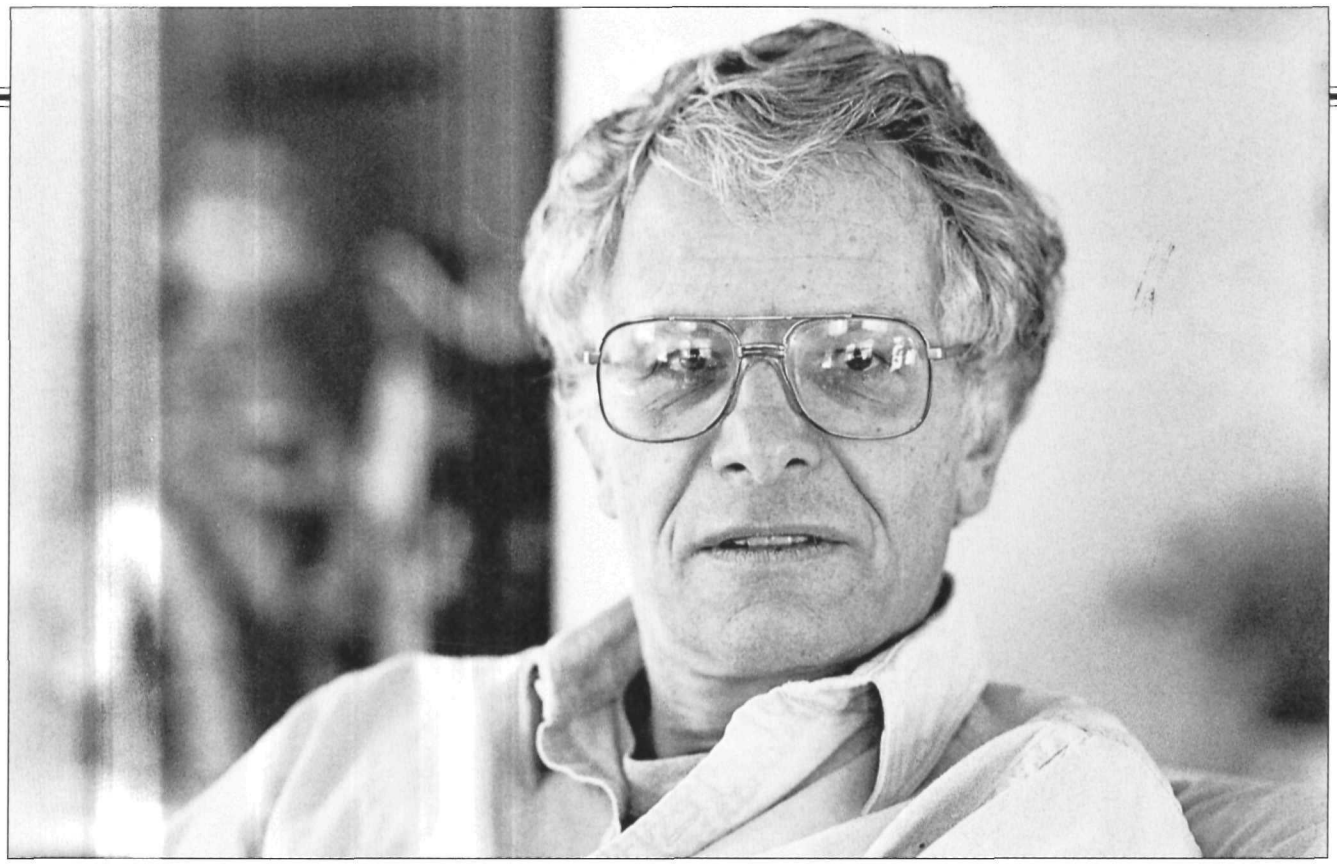
What that means, he hopes, is that he and other Georgia Tech professors who have been meeting for dinner every so often will eventually teach a freshman course "that will make Georgia Tech a more interesting place for its youngest and most impressionable members. I think this little group of professors can get together and think about some things at Tech as a whole, rather than just their individual research centers or departments. There's potential here to do something different."

One of his disappointments, Nemhauser says, is that his research and his work with PhD students prevent him from spending more time in the classroom. "I've always retained a love for teaching," he says. "I want to get back to freshman students."

Although Nemhauser

The Nemhauser File

- **Born**—The Bronx, New York City, 1937
- **Education**—Ch.E., City College of New York, 1958; MS Ch.E. (1959), PhD (1961) in Operations Research and Industrial Engineering, Northwestern University
- **Family**—Wife Ellen; one son, Dennis; one daughter, Wendy; and a granddaughter, Jordan.
- **Quote**—What I do is to try to figure out how to optimize complex systems. This is challenging and fun when you have the good fortune to see a major improvement result from the work of your group. I am optimistic that this kind of effort will help make the U.S. a more competitive nation.
- **Professional Interests**—Operations Research, Optimization, and Discrete Mathematics.
- **Professional Achievements**—Member, National Academy of Engineering; author of more than 80 papers in refereed journals and three books (only author to twice receive the Lanchester Prize of the Operations Research Society of America); past chairman, Mathematical Programming Society; past president, Operations Research Society of America; founder/editor, *Operations Research Letters*.
- **Leisure Activities and Interests**—Tennis, hiking, folk art, community affairs, theater, and civic affairs.
- **Persons most admired**—Dr. Jack Mitten, his mentor at Northwestern University, and Belgian economist Dr. Jacques Dreze.



Tech's George Nemhauser: Pioneer in a new discipline, he helps guide the field of operations research toward "maturity now."

had no trouble at the famed Bronx High School of Science or CCNY, he says he wasn't at the time "a great student or a serious student. I had a high I.Q., but beyond that I had never worked really hard. Then I met Professor Mitten my first year at Northwestern, and he got me really intrigued by some interesting mathematical problems that seemed to have exciting applications. I was never a pure mathematician nor a scientist—I didn't like physics—but under Dr. Mitten I learned about applying math to the real world, the world of business, the world of economics. That really turned me on."

After receiving his PhD, Nemhauser went to Johns Hopkins as an assistant professor, and from there he went to Cornell University. This was an exciting time for his field, as studies of math and science were exploding in the aftermath of the Soviet launch of the first satellite—Sputnik—into orbit. In addition to working in Belgium, Nemhauser worked in England for a year. In 1977, he became director of the School of Operations Research and Industrial Engineering at Cornell. Dr. Michael E. Thomas, executive vice president at Georgia Tech, persuaded Nemhauser in the fall of 1985 to take the A. Russell Chandler III Chair in Industrial and Systems Engineering as a visiting professor.

"By January my wife, Ellen, and I decided it was the right time to move," Nemhauser said. "One child had just finished college and one had just finished high school, and my wife and I had fallen in love with Atlanta and Tech."

The Nemhausers have become bona fide civic- and culturally minded Atlantans. They partake of as much local theater as possible (that, folk art, hiking and tennis are among Nemhauser's great non-academic passions), and Ellen is active in the Druid Hills Civic Association. Indeed, Nemhauser speaks of defeating a developer who wanted to build high-density apartments in that neighborhood with the relish he devotes to his research and another great passion: Georgia Tech basketball. A poster of a recent Yellow Jacket basketball team has a prominent place in his office.

Nemhauser applies operations research to business. He is working on a problem now for Delta Air Lines involving "optimization of aircraft utilization." When he and his graduate and post-doctoral students work it all out, Delta may save some $3 million a month.

Looking back on his academic career, Nemhauser is proud of his specialty, even if its name confuses people. "I work in a field that you might not even want to call a discipline," he says. "Operations Research cuts across problem areas. I like to think of it as reaching a level of maturity now. It's a field that I love." ■

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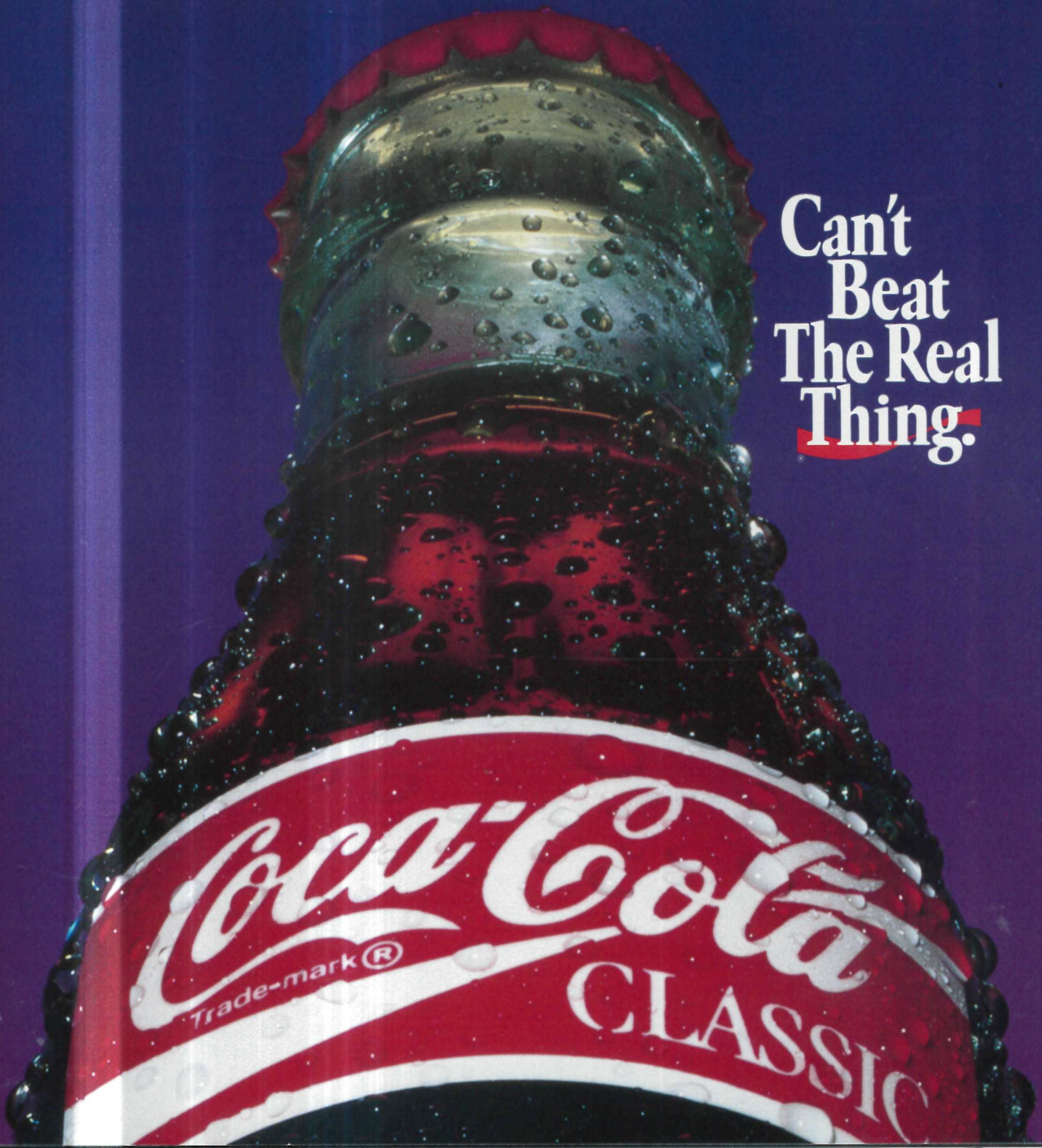

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