vistas

TEXAS TECH RESEARCH // SPRING 2005 // VOL. 13 NO.1

SAVING VIETNAM

MEMORIES OF 'NAM:

30 Years After the Fall of Saigon

VIST

TEXAS TECH RESEARCH.SP

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e editor's note 13.1

SPRING 2005 VOLUME 13 NO.1

REMEMBERING AN INDIVIDUAL'S LEGACY HONORS

a life well-lived. Jean Brashear Nichols, a researcher and farmer whose land adjoined the Texas Tech New Deal Farm, lost her life Jan. 30, 2005, in an automobile accident. Traveling with Texas Tech researchers Cliff Fedler and Nick Parker to Colorado, Jean was a voice for educational-community partnerships in agriculture. Working on solutions to increase value-added production on farms, researchers are exploring natural resources, such as wind, solar and biomass energy, and have formed the Global Scientific Research Corporation. "Jean was willing to do her part in joining forces with people, even for a wild idea, where she thought she could make a difference," Cliff Fedler said. She blended her lifetime experiences as a woman in agriculture and her doctorate in land use, planning and management to become a vocal proponent of the research. "Jean saw potential in ideas and individuals. She believed in others, often before they believed in themselves," said colleague Bob Rogers. As a first-hand producer, she opened many doors between academia and the community. "Jean was willing to look beyond, to seek change; she was unusual in the agricultural community. She can't be replaced," said Nick Parker. Jean's passions also led to her tremendous support for the Women's Studies Program. "She brought sensitivity to the status of women in the agricultural community. Jean's energy, spirit, financial support, participation and presence were valuable assets to the program. Jean will be missed by everybody in women's studies," said Gwen Sorell, former program director. Parker emphasizes, "We need to pay attention to what Jean was teaching us all." — *Kippra D. Hopper, Editor*

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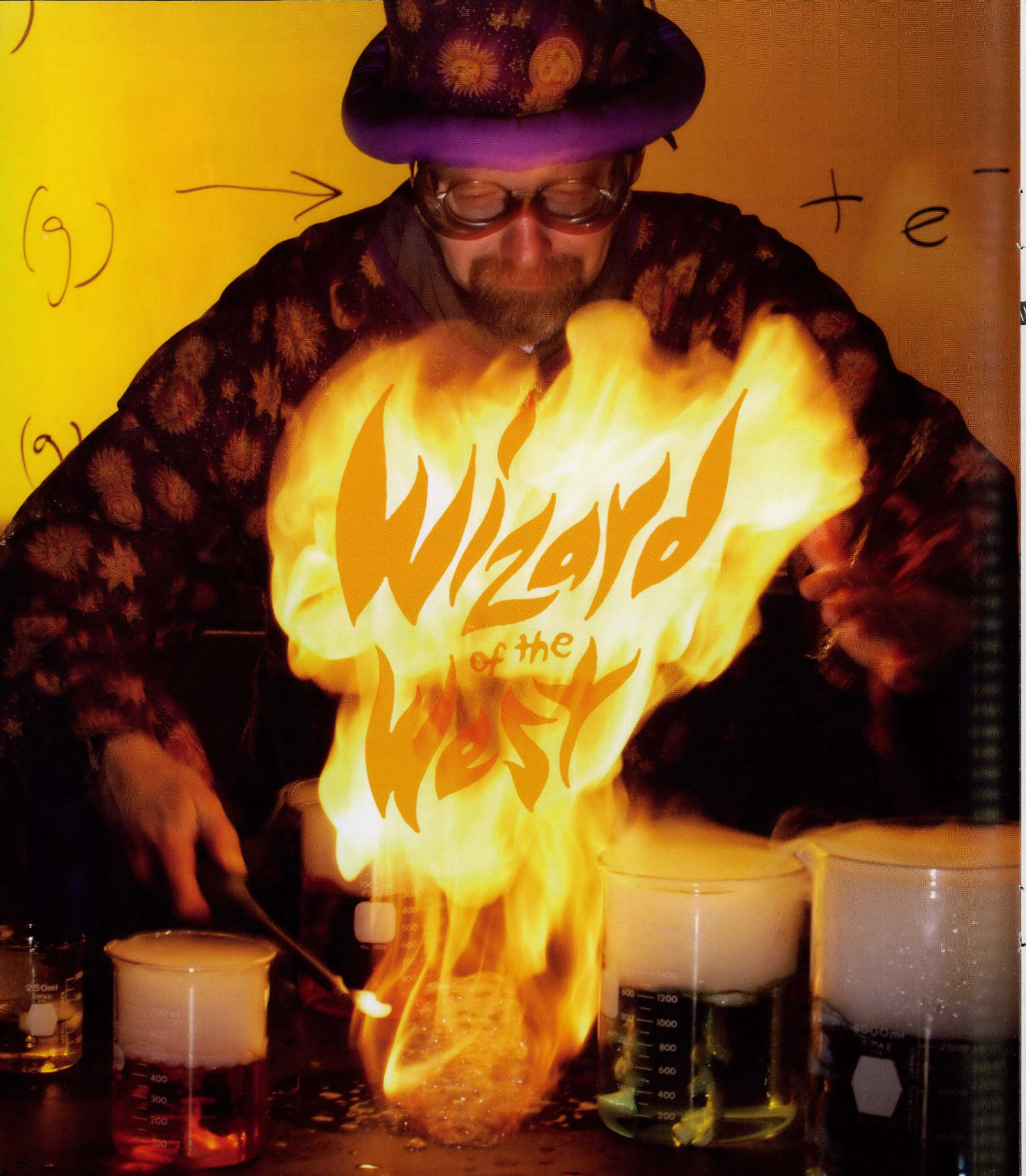
SAVING VIETNAM

Forty years after the United States sent ground troops to Vietnam, America's longest and most divisive war in history, will never be forgotten through the Texas Tech Vietnam Project.

by Kippra D. Hopper

COVER STORY


Wizard
of the
West

ARTIE LIMMER

BY KIPPRA D. HOPPER

sorcerer

Dominick Casadonte has taken his magic science show on the road for 10 years exhibiting the enchantment and transforming power of chemistry. With magician's hat on, Casadonte brings his love for science to people of the region in hopes of encouraging others' interest in science.

Traveling throughout Texas and New Mexico, Casadonte, professor of chemistry at Texas Tech University, has performed more than 250 chemical demonstrations to audiences totaling more than 30,000 people. His goal is to put the younger and older generations together in science classrooms, with seniors volunteering as teachers' aides to mentor children in elementary or junior high schools.

Project Seniors SERVE (Science Enrichment using Retired Volunteer Educators), a National Science Foundation Discovery Corps Fellowship project, offers retired senior citizens who have not taught science an opportunity to learn basic science and to assist teachers. "Retired senior citizens have a lot to offer our communities. They have experiences, knowledge, understanding and time to give. Many senior citizens also have an interest in continuing to learn," Casadonte says. "Our children need positive influences in their lives, and our teachers need support in the classroom."

Although similar programs exist in which seniors help school children learn to read, the model is unique in the field of science, Casadonte says. He believes that a "wise elder-to-student knowledge transfer" will have a beneficial effect in the teaching of science for both the seniors and students. And, he hopes to provide a productive new educational paradigm in a variety of subjects.

"This is a good idea because in many cases children, especially those in lower socioeconomic schools, have parents who are single or have to work long hours, thus having less time to spend with their children," he says.

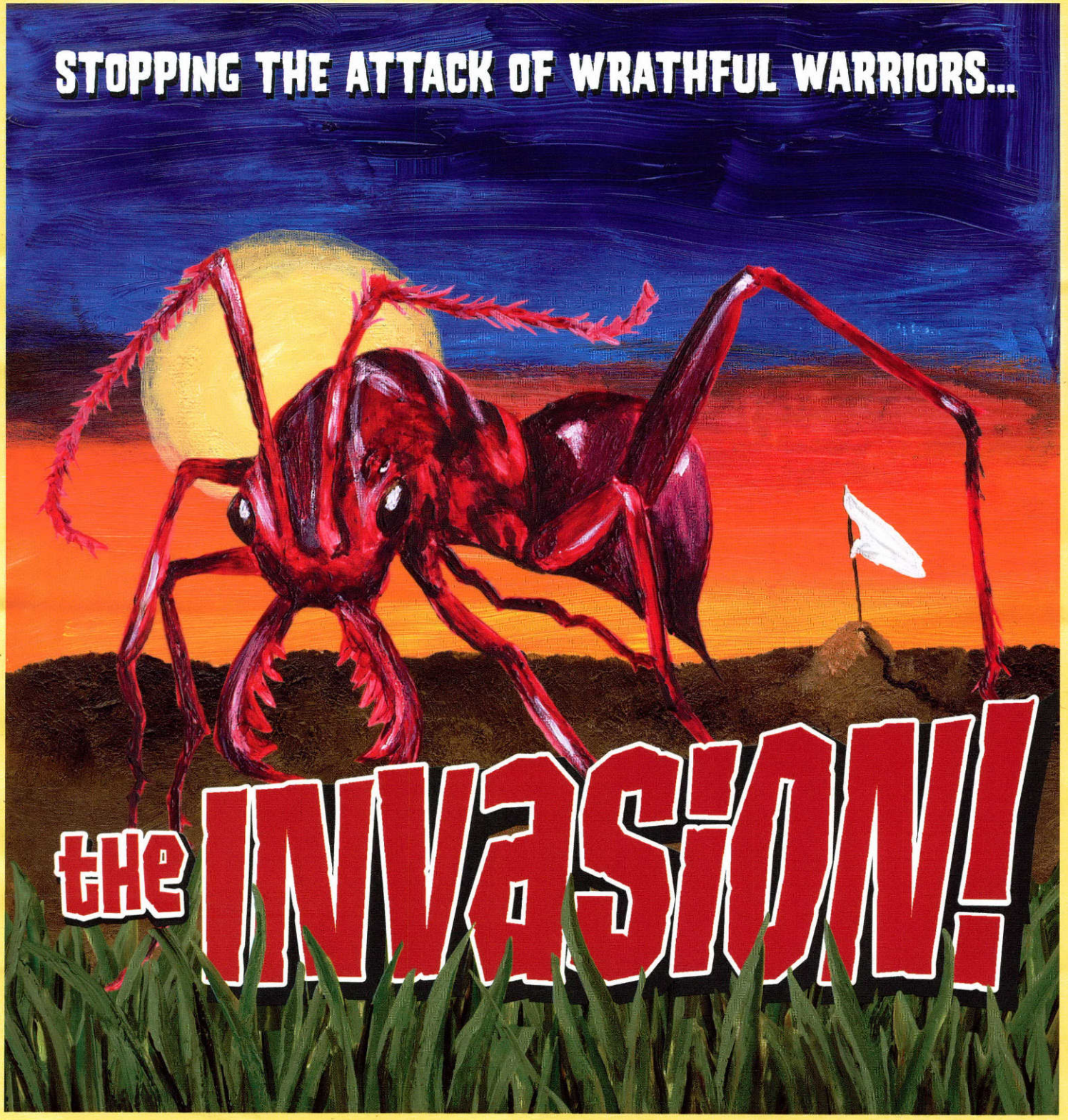
In this pilot project, Project SERVE teaches senior citizens without a science background the fifth- and eighth-grade chemistry curriculum and age-appropriate pedagogy in a 12-week period. After the training, Casadonte's first class of 12 seniors will help in eight Lubbock Independent School District classrooms, acting as teachers' aides and mentors. The schools were selected based on their status as underperforming and because their students are from disadvantaged backgrounds. Having control and experimental groups for each of the grades, Casadonte and his team of researchers will assess all of the benefits to seniors as they progress through the project, such as physical health, energy level, attitudes toward themselves, as well as their science content knowledge. The researchers also will test the children's learning to determine any educational impact to schoolchildren.

"The seniors involved in the pilot study are an amazing group of people. We have volunteers ranging from retired engineers, clergy members, school teachers, school counselors, nurses and business people. These are first class individuals who have willingly decided to give up a year of their time for this pilot project," Casadonte says.

Throughout the project, the seniors will be keeping journals to help Casadonte and his research team develop a model of service learning pedagogy. In the journals, seniors will reflect on their service, what it means to them, and how their thinking also might be changing in response to what they are learning.

From a broad perspective, the study addresses the national "No Child Left Behind" policy regarding student retention. "Through the interest, stimulation, excitement and personal relationships produced as a result of senior-student interaction, we hope that more students from diverse backgrounds will express an interest in a career in science and technology. This is especially important in the chemical sciences, as the number of students showing an interest in chemistry as a career choice has decreased in the past decade," Casadonte says.

With long-term goals of establishing a nationwide senior core of volunteers for the classroom, Casadonte is beginning the first project of its kind in the country. Through the intergenerational teaching and learning of chemistry—the central science—Casadonte is hoping the magic of science and technology will cross the generations.←



TEXAS TECH UNIVERSITY PRESENTS **THE INVASION!** TTU | DEPARTMENT OF RANGE, WILDLIFE & FISHERIES MANAGEMENT

BASED ON THE BOOK GROWING GRASS TO REPEL THE MASS RESEARCH BY PROFESSOR GAD PERRY, PH.D. CO-STAR PROFESSOR CARLTON BRITTON, PH.D.

SCREENPLAY WRITTEN BY TIFFANY BERRY FILM EDITING BY KIPPRA D. HOPPER, M.A. ILLUSTRATED BY MISTY POLLARD

FILMED IN WEST TEXAS • PRODUCED BY ANT MOUNDS ABOUND PRODUCTION COMPANY, LUBBOCK, TEXAS

ILLUSTRATION: MISTY POLLARD

BY TIFFANY BERRY

marching

onto their battlefields is part of this army's daily routine. Though small, their wrath can be as big as their determination. This army is not native to the United States, but instead is comprised of foreign invaders. Lacking natural enemies, the army has spread to all portions of the U.S. East Coast and is sweeping across Texas faster than one can say eradicate. This army of Red Imported Fire Ants is a threat throughout the United States and continues to be a hazard to the agriculture industry.

The Red Imported Fire Ant was carried to the United States during the 1930s from South America and has spread to infest more than 260 million acres, reaching the state of Texas during the 1950s. This diligent army can travel long distances via cars, trucks or truck shipments, or nursery stock and soil.

Depending on the troop, they can be led by a single queen or multiple queens. Areas infested with single queen colonies contain 40 to 150 mounds per acre. Researchers have found that in areas with multiple queen colonies, as many as 200 or more mounds and 40 million ants per acre are working hard defending their battlefields.

These ants are aggressive when disturbed and defensively will attack anything that agitates their mound's food source. They inject venom containing an alkaloid, Solenopsin A, that is toxic to cells when the ants bite.

This army is an increasingly substantial problem for managers of both agricultural and conservation lands. A recent study estimated that the annual damage to the cattle industry in Texas alone from these fierce warriors is approximately $255 million. Research studies have addressed ways to control the fire ants, with many of those studies conducted at Texas Tech University.

Texas Tech Professors in the Department of Range, Wildlife and Fisheries Management, Gad Perry, Ph.D., and Carlton Britton, Ph.D., have discovered that this pesky army might have a natural enemy already here on the green earth.

"As the ants started to expand, an apparent pattern started emerging. Although the ants are found in high densities in most types of fields, the adjacent fields planted with W.W.-B. Dahl grass shows a much lower density of ant mounds," says Perry. "In fact, several fields with the specialized grass had no ant mounds that could be detected."

The original seed for this particular grass was collected near Manali, India, in 1960. The grass is named after the late Bill Dahl, a former Texas Tech faculty member. He first planted and evaluated the grass in West Texas.

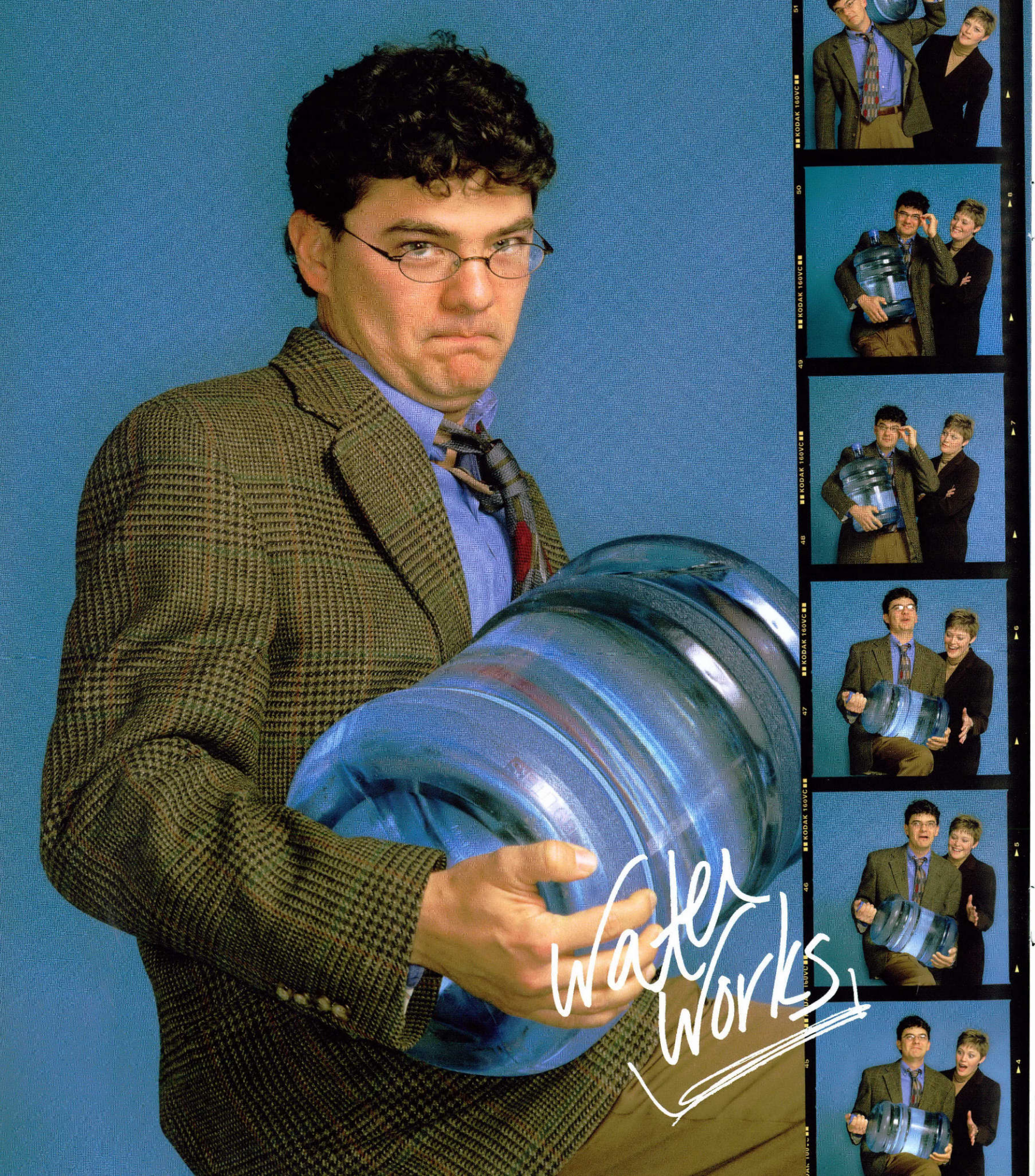
"This grass is a warm-season, tufted, perennial bunchgrass that has larger leaves and more foliage than native species. It has consistently produced 10,000 to 12,000 pounds of forage per acre in central Texas and across most of Texas," said Britton.

Observations of cattle grazing show that animals prefer the grass. At the Texas Tech experimental ranch, steers graze the grass in preference to other species. The Dahl grass also requires less fertilizer and is less expensive to maintain than Bermuda grass.

To expand the study, the researchers decided to look at other ants existing on the High Plains to explore the theory that they may not like the W.W.-B. Dahl grass as well. Scholars will next research the properties of the special grass to determine what elements in the grass make it a natural enemy for this army of invaders. Perry says eventually, researchers would like to develop a spray out of the qualities in this grass that would help eradicate these pesky critters.

"There's an indication that the ants depredate or kill quail and other small animals. If the animals happen to be in the wrong place, there is no way to stop the ants from killing them," explains Perry. "If a type of grass can repel this species of ant, the agricultural industry could benefit greatly."

Finding a natural enemy to battle this army potentially could rescue the agriculture industry from the damage and money lost from the invasion of the Red Imported Fire Ant. Texas Tech is on its way to encouraging this army of ants to raise its white flag and surrender.←


Water Works

ARTIE LIMMER

BY KIPPRA D. HOPPER

life

on Earth has always been sustained by plenty of potable water. Having enough of it—both now and in the future—is an issue that transcends time and space. Andrew Jackson, Ph.D., and his Texas Tech University research team are hoping to find the answers to the challenges of adequate water resources for the near and distant future.

Scientists from various disciplines, under the umbrella of the Space Science Center at Texas Tech, are combining their knowledge to answer an essential issue for astronauts and space exploration: How can technology and science be used to find ways to provide clean water to astronauts particularly on long-duration missions? The research team is evaluating the suitability of biological wastewater treatment methods for NASA's long-duration space missions, an initiative established in 2004 by President George W. Bush.

To undertake these long-term missions to the Moon, to Mars or to the International Space Station, NASA's scientists must overcome life support issues. Primarily, they must determine how technology can provide enough drinking water for years for humans in space when the original water payload has weight limitations. "We take the wastewater that is produced, treat it back to drinking water and then start again," Jackson says. "We've been specifically looking at biological pre-treatment by using microorganisms to treat the wastewater. With biological pre-treatment, the post processors that finish, or polish off, the water do not have to use as much energy or consume as many expendables."

To achieve the desired results, Jackson, an associate professor of civil engineering, and Audra Morse, Ph.D., one of the key researchers on the team, developed the applicability of membrane-aerated bioreactors for wastewater reclamation. The objects look like clear columns filled with various filters and hoses. Additionally, the team is focusing on the fate of pharmaceuticals and surfactants, or soaps, in water and in the development of mathematical models to describe the water reclamation system.

The same issues that astronauts face in space regarding water resources are applicable to similar issues on Earth. Eventually, Jackson insists, humans will be forced to take wastewater and recycle it back to drinking water. "We're running out of potable water, and we are approaching the end of new sources of drinking water, so we are going to have to start looking at some water sources that we otherwise would not have looked at, and one of those is going to be wastewater. In an area like Lubbock, Texas, right now, there is water, but in 50 or 100 years, we are going to run out and have to look for other resources. We already are talking about using the wastewater for irrigation, so treatment is going to have to occur."

A major goal for NASA is to take the technology developed for the space environment and apply it to the terrestrial environment. What the Texas Tech researchers, funded through NASA, learn about their recycling technology in space will help scholars on Earth understand how to continue to provide adequate water supplies for both consumption and irrigation, especially in arid and semi-arid areas, such as West Texas. The Texas Tech Water Resources Center has been involved in working to transfer wastewater reclamation technology to residents lacking wastewater treatment in the Green Valley Farms Colonia in San Benito, Texas.

Using microorganisms to clean water is the primary process used to recycle water. "People use hundreds of gallons of water each day in output, for example in using washing machines or showers that dilute some of the waste, the nutrients and the organic matter," Jackson explains.

While the problems in the space and terrestrial environments may be the same, the technologies required to solve the water issues are dramatically different. In space, scientists face numerous problems, Jackson says, such as the required limited volume that can be taken into space. Secondly, limited or no gravity in space means that technologies that work on Earth will not necessarily work in space. Thirdly, the water in space has a very high concentration of waste because of the extremely small volume of water generated by each astronaut that is recycled into clean water.

Out in space, wastewater treatment technology may include the use of plants after treating the water in biological reactors for two outcomes: growing plants for food consumption and capturing water vapor transpired by the plants for drinking water. "The plants actually act as a distillation system. The water they evaporate can be condensed and is extremely clean. Because the biologically treated effluent still contains nutrients, NASA is saved from having to ship nutrients into space by growing plants," Jackson says.

In the plant process, the plants take up the water, the water evaporates, and engineers condense that water. Evaporated water is very clean because all the salts are left behind. In effluent, a major problem is with salts. The Texas Tech researchers specifically are looking at the chive plant. Ellen Peffley, Ph.D., professor of plant and soil sciences, has worked for years with NASA concentrating on how to grow plants in space. Chives are a demonstration plant, and researchers will be branching out to other food crops, especially those plants whose roots can be separated from the tops.

Bacteria, like humans, have to eat and breathe something, generally organic matter. Not finicky, bacteria will eat the undesired organic matter in the wastewater. The nitrates are not originally present in wastewater, but other bacteria prefer to eat ammonium and breathe oxygen.

"Basically we are providing an environment to allow bacteria to eat organic matter, and in this case, to breathe nitrates as opposed to oxygen. Engineers want to rid the wastewater of salts, nitrates, ammonium and organic matter. We're getting rid of nitrates and organic matter simultaneously," Jackson says.

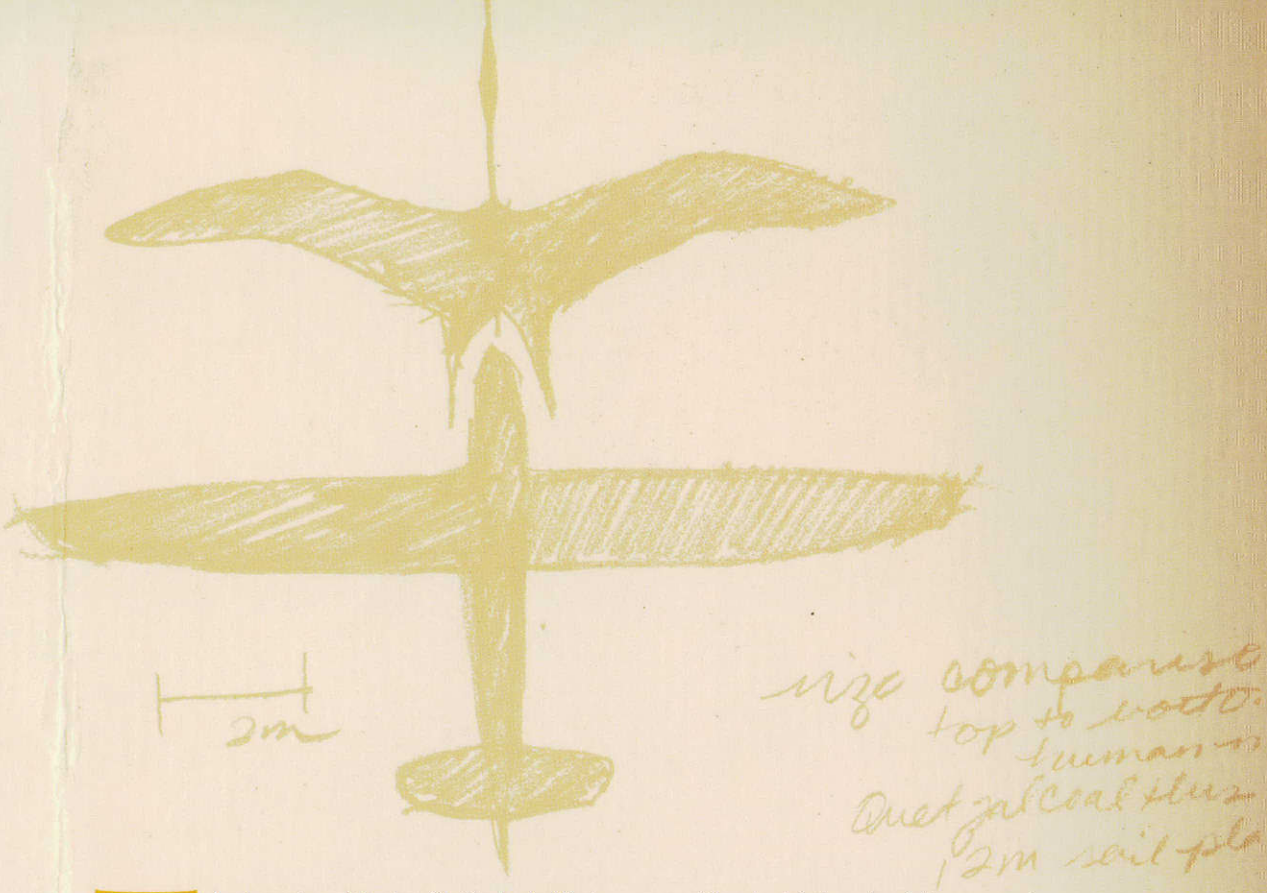
In attempting to address the continuous supply of water for decades and generations to come, Jackson and his team are reflecting upon the future and are addressing the major and real issue of the maintenance of potable water for life on Earth or in space.

ANDREW JACKSON AND AUDRA MORSE ARE WRESTLING WITH THE GRAVITY OF FUTURE WATER NEEDS IN SPACE AND ON LAND.

SPRING 2005 VOLUME 13 NO.1

A Theory of FIGHT

WRITTEN BY: KIPPRA HOPPER
PHOTOS BY: ARTIE LIMMER



The tapestry of Sankar Chatterjee's life is woven with colorful threads of his personal story, his life's work and his contributions to science. Intertwined throughout this fabric is his curiosity about geology, paleontology and time measured in aeons. Creating the texture of the cloth are Chatterjee's passions for dinosaurs, birds, pterosaurs and plate tectonics. When viewed as a coherent whole, the material reveals complicated pictorial designs of Chatterjee and his cache of fossil finds, scores of which are unique specimens new to science. Magnified, the interlacing of the weave illuminates his pioneering discoveries that challenge conventional wisdom about the pace of evolution and its patterns of change. The binding around the edges of the textile, holding together all of the threads, is Chatterjee's fascination with ancient birds and the evolution of flight in feathered dinosaurs. The hand-woven art possesses color, design, variety, beauty and complexity in its depiction of ancient creatures and their time and place on Earth. The tapestry of Sankar Chatterjee's life hangs on the walls of history and science.

In the basement of the Museum of Texas Tech University, Chatterjee has spent nearly three decades deciphering the fossils he has discovered across the continents, from his native India, to China, Europe, Antarctica and the American Southwest. The Paul Whitfield Horn Professor of Geosciences and Museum Science and Curator of Paleontology at Texas Tech University has trekked through the ages to find specimen upon specimen of ancient creatures that create a chronology of the planet's time clock. The unearthed bones and fossils have kept Chatterjee in the ranks of modern scientific pioneers as a greatly cited internationally known scholar on the evolution of flight in pterosaurs and birds. Pterosaurs were members of flying reptiles.

Chatterjee's life story is nothing short of fascinating, and the culmination of his work has taken an imaginative twist. Revealing what we can learn from nature and the ways in which the past informs the future, Chatterjee's discoveries are enlightening the faraway visions of human flight and space exploration. Intrigued by the research, officials with the National Aeronautical Space Agency (NASA) are interested in applying the new paleontological knowledge toward building future planes with flexible wings that simulate birds and their flight. On the horizon, where sky meets land, birds and their natural secrets are linked with space flight.

PREVIOUS PAGE: SANKAR CHATTERJEE WITH QUETZALCOATLUS NORTHROPI.

ADMINISTRATORS DAVID DEAN AND GARY EDSON ADMIRE THE COMPLETION OF CHATTERJEE'S LONGTIME DREAM OF A PERMANENT DINOSAUR EXHIBIT AT THE MUSEUM OF TEXAS TECH UNIVERSITY.

The stuff of Jurassic Park, dinosaurs captivate young and old alike, with the curiosity of mysterious, ancient and lost worlds. Pointing to the incredible value of basic research, this seemingly esoteric study of bones and fossils portrays how science for its own sake can have unforeseen ramifications in human knowledge and activities. This joining of the Earth's deep history with the universe's future technology has emerged from a unique collaboration between Chatterjee and research partner R.J. Templin. A retired aeronautical engineer living in Ottawa, Canada, Templin one time served as the head of the Aeronautical Division of the National Research Council of Canada, an equivalent of NASA. The two have combined their respective knowledge about time and space to precisely calculate how pterosaurs and birds, which evolved about 225 million years ago, developed the ability to take flight.

While scientists had established that pterosaurs and ancient birds could fly, no one had ever answered the question about their flight performance. Through tedious calculations, computer simulations and intense research, Chatterjee and Templin joined their respective knowledge about animals and flight mechanics to answer the mystery that has lingered in the scientific world for 30 years. Their definitive work, titled "Posture, Locomotion and Paleoecology of Pterosaurs," has been published as a special monograph of the prestigious *Geological Society of America*. Members of an order of flying reptiles with crocodile-like skulls, but bird-like hollow bones, pterosaurs became extinct with the dinosaurs 65 million years ago. In that world, the pterosaurs—the largest creatures ever to fly—filled the skies; and birds, descendants of theropods, or the carnivorous dinosaurs, also came onto the scene. The secret code that joins the past to the future lies within the evolving design of the wings—those of birds, pterosaurs and human-built aircraft.

Pterosaurs were not dinosaurs, nor were they birds. "Pterosaurs could fly like birds, and they flew above the heads of dinosaurs. Some were small, like a modern sparrow, and some were large, like an F-16 plane. These animals are very enigmatic because they are extinct and we have no modern animals with which to compare. Pterosaurs seem to be half bat, half bird, but actually they are reptiles," Chatterjee explains. "The family of birds with dinosaurs brings a new twist in the extinction debate. The similar anatomy suggests that birds and dinosaurs are closely related and they shared a common ancestry. Currently, birds are considered living dinosaurs, the direct descendents of theropods. If so, dinosaurs did not die out completely. While it is true that all the terrestrial forms are gone forever, one group of dinosaurs escaped this catastrophe. They are still around us—flying, hopping, perching, singing and nesting. They inspired us to fly and to invent the airplane. We call them birds."

In Chatterjee's laboratory, a reconstructed skeleton of one of his seminal bird finds from Antarctica, *Polarornis*, from the last days of dinosaurs, delicately hangs in the air, surrounded by cabinets full of archived fossil finds, carefully arranged casts of bones, and hunks of rocks that hold the ancient forms within. All precious materials from across the continents, these treasures hold secrets that explicate Chatterjee's paleontological journeys as well as those of his predecessor at Texas Tech, the late scientist F. Alton Wade (1903-1978). A pioneer for his work in Antarctica, Wade left a legacy in creating a collection of amazing and rare artifacts that lured Chatterjee to Texas Tech.

Born in Calcutta, Chatterjee felt compelled to study the continental relationship between his native homeland of India and Antarctica, which long ago were joined together. He earned three degrees, including his doctorate, with honors in the field of geology while he attended Jadavpur and Calcutta universities. During his university education, Chatterjee met a British paleontologist, Pamela Robinson, Ph.D., of London University, who invited him to join her in working in the lush Godavari Valley in southeastern India. "In that first year, I found many fossils, including the world's first full skeletons of the short-legged, beaked *rhynchosaurs*," Chatterjee smiles, noting that after that first experience, he became a fanatic for finding fossils. Chatterjee spent a year at London University

with Robinson as a pre-doctoral fellow to learn the nitty-gritty of paleontology. Starting his career in America as a visiting professor at the University of California, Berkeley, and a postdoctoral fellow at the Smithsonian Institution, Chatterjee found his way to Texas Tech in 1979, encouraged by the university's open doorway to the South Pole.

"Texas Tech had this beautiful and ongoing research on Antarctica, which is very specialized research. Nobody can just start from scratch; you have to have some kind of heritage to grow from. Wade was a genius of a man, but he did not write much; he kept everything in his brain."

In archiving Wade's papers, Chatterjee learned that Wade's expertise of Antarctica preceded his arrival at Texas Tech. In 1933, Wade made his first visit to the south pole as a dog sled driver on Admiral Richard Byrd's second expedition to the continent. From that trip, he brought back artifacts, such as canned food goods, from the earlier, ill-fated expedition undertaken by Captain Robert F. Scott, the British explorer who died in 1912 along with his entire party. While acting as Admiral Byrd's chief scientist on the 1939-1941 expedition, Wade suffered severe frostbite and narrowly missed falling into a crevasse. While a Horn Professor of Geology at Texas Tech, Wade led five expeditions to the continent, with his last visit in 1969. At the time of his death, he was working on the preparation of additional geological maps of Antarctica. Chatterjee completed Wade's unfinished work and undertook his own by exploring Antarctica with his students on four occasions, the last time in 1985. The specimens gathered on the frozen continent by Texas Tech scientists over the decades have made Chatterjee the curator of the largest Antarctic rock, historical artifact and fossil collection currently in the United States.

> "For 1,000 years we envied birds because they could fly, and no doubt, watching birds fly, we invented the plane."
> -Chatterjee

That fossil collection, along with the evidence of Chatterjee's ongoing, international and rare discoveries, has emerged from the paleontology laboratory and the annals of science to come into public view. Reflecting his 30-year-long research at Texas Tech, a permanent collection of artifacts is being displayed in the new Dinosaur Gallery at the Museum of Texas Tech. Chatterjee's longtime dream, the exhibit is a comprehensive portrait of his work in fossil expeditions across continents, the origin of birds and their flights from theropod dinosaurs, the flight of pterosaurs, dinosaur extinction and plate tectonics. The new permanent collection, "A Changing World: Dinosaurs, Diversity and Drifting Continents," makes Texas Tech one of only 10 higher education institutions in the nation that have dinosaur collections and exhibits, notes Chatterjee. "While we cannot compete with the Smithsonian or the American Museum of Natural History, we wanted to create the dinosaur hall to leave something to the Lubbock community, and especially to the children, who love dinosaurs so much. The Dinosaur Hall is often the window through which many children and adults first are introduced to science and natural history."

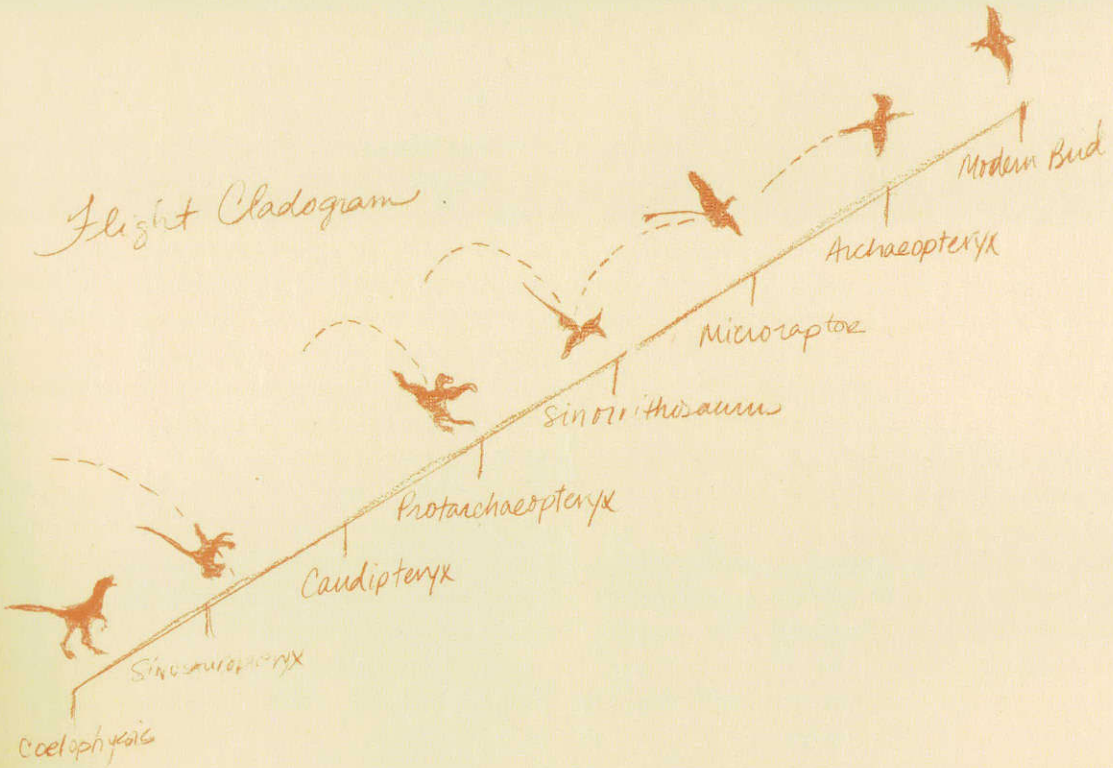
Traveling the world in search of discovery, Chatterjee returns to his own big back yard in West Texas where he has unearthed the remnants of creatures never known before to science. Several dig sites on private ranch lands near Post, Texas, just outside of Lubbock, have remained Chatterjee's gold mines and have yielded veins of fossils that have helped him to understand the pattern of evolution and flight. After a native West Texas student told him about the first site, Chatterjee and his crew obtained permission from ranchers to use jackhammers to dig into the red mudstone of a Late Triassic Dockum Group to unearth their finds. These red bed formations date 225 million years ago in the early Mesozoic era, very similar to those found in the Palo Duro Canyon, and easily are recognizable as the mesas rising throughout the Caprock Escarpment, where massive flash floods preserved the animals.

From those digs, Chatterjee has found dozens and dozens of remarkable fossils, including North America's first-known bird-hipped dinosaur, which he gave the moniker *Technosaurus* in honor of his academic home. He further found and named the earliest toothless dinosaur, *Shuvosaurus*, (named after his son, Shuvo, who found the specimen as a young child); and the terror of the Triassic, *Postosuchus*, (named after the town of Post), and its bite-sized prey *Rileymillerus*, (named after the rancher Riley Miller). Rocking the Earth's biological clock, Chatterjee made a major discovery when he found *Protoavis texensis* (the first bird of Texas), the world's oldest known bird species considered to be the ancestor to modern birds. *Protoavis* looked half-dinosaur, half-bird, reinforcing the hypothesis that birds evolved from dinosaurs. With the find, Chatterjee set back the Earth's biological clock and dated the fossil to be from 225 million years ago. The find meant that birds and dinosaurs may have had a common ancestor, though the original life form remained a mystery. In the same site where he found *Protoavis*, Chatterjee also found two of the earliest dinosaurs. What Chatterjee had not encountered while sifting through his findings from the field were preserved feathers of the flying creatures.

Chatterjee proclaims ours to be the enchanting land that heralded the age of dinosaurs. "Here in West Texas, it was a flowing river. These animals died because of a flash flood with very high energy. You never find feathers in this condition. The Caprock was once part of a lush tropical area dotted with flowing rivers and lakes. The abundance of fossils it contains indicates many creatures were trapped together. Most people in this region do not know that early dinosaurs lived around the edge of the Caprock."

Mesozoic Era

248 ma Triassic | 205 ma Triassic



Chatterjee contended in his 1997 book, "The Rise of Birds: 225 Million Years of Evolution" (The Johns Hopkins University Press), that *Protoavis*, a pheasant-sized creature, may be the long-lost ancestor of all birds. "In my book, I predicted that the ancestor of the bird would be a small dinosaur that evolved into being able to climb trees," Chatterjee recalls. "In China, scientists found exactly the same thing I had predicted, a small, climbing feathered theropod, ancestral to all birds. They found not one, but hundreds of thousands, of chicken-sized dinosaurs, with full feathers of different stages, from downy feathers to contour feathers to asymmetric flight feathers. Outside of Beijing, in an area in the Liaoning Province Chatterjee dubs as "Cretaceous Pompeii," ancient lake beds enfold hundreds of feathered dinosaurs, early birds, pterosaurs, mammals, fish, insects and plants. The specimens were preserved exquisitely, entombed by occasional volcanic eruptions. "Exactly the same thing that happened in Pompeii also happened at the Liaoning fossil site. Ash has a property of preserving everything, and in China we can see layer after layer of complete skeletal fossils that are just mind-boggling," Chatterjee explains. "The animals lived near a large lake in a forest, with a volcano nearby. Every two or three years, the volcano ruptured, and the poisonous gas from volcanoes killed everything. All the birds and dinosaurs fell into the lakes, went to the bottom and were covered by ash beds. I was fortunate to visit the Liaoning site, which is probably the most important paleontologic discovery in the 20th century, and to work on the flight mechanisms of these feathered dinosaurs." Chatterjee and Templin recently, through the University of Indiana Press, published a landmark paper on the flight performance of the feathered dinosaurs from China, which appeared in an edited volume, "Feathered Dragons," referring to the pterosaur finds.

Soon after the announcement of his major find of *Protoavis*, Chatterjee was quoted in a *Boston Globe* magazine article as attributing his paleontological successes of finding new species simply to luck. However, while that intangible quality may be a part of digging up dinosaurs, University of Colorado paleontologist Robert Bakker noted at the time, "Sankar has a halo around his head."

Finding so much Triassic life in West Texas, Chatterjee soon garnered the attention of the National Geographic Society, which funded the Post quarry since the 1980s along with the National Science Foundation, the National Geographic Foundation, the Smithsonian Institution, and the Dinosaur Research Society, among others. Chatterjee also recognizes the friendliness and support of the local ranchers for his paleontologic research. His work since has been featured in documentaries produced by the National Geographic Society, Public Broadcasting Station's NOVA and the Discovery Channel. His publications have been accepted by numerous prestigious scientific journals, such as *Science*, *Nature*, *Scientific American*, *Discovery* and *Geological Society of India*. News of his finds have been covered by respected media, such as CBS, CNN and PBS, *Time*, *New York Times*, *Life*, *London Times*, *Pravda*, *World Book* and *Encyclopedia Britannica*. For his scientific contributions, Chatterjee has received numerous honors and awards including the Antarctic Service Medal, Headliner Award, Elected Fellow of the Geological Society of America and the American Association

for the Advancement of Science, Scientist of the Year Award and Honorary Member of the Golden Key National Honor Society.

The current scholarship by Chatterjee and Templin again is fetching the attention of the National Geographic Society documentary filmmakers and the world of science. "For 1,000 years we envied birds because they could fly, and no doubt, watching birds fly, we invented the plane," Chatterjee says, pointing out that NASA officials will build future aircraft based on this natural model of flight for the first time. Complex and difficult, NASA's designers and engineers will be attuned to the researchers' observations that pterosaurs and birds did not have fixed wings, like today's aircraft. Instead, the creatures had flexible wings that could fold into the body as well as expand into limbs required for flight. They evolved into being able to twist their wingtips to take advantage of the forces of thrust and drag, in the same way that humans turn their hands as they swim.

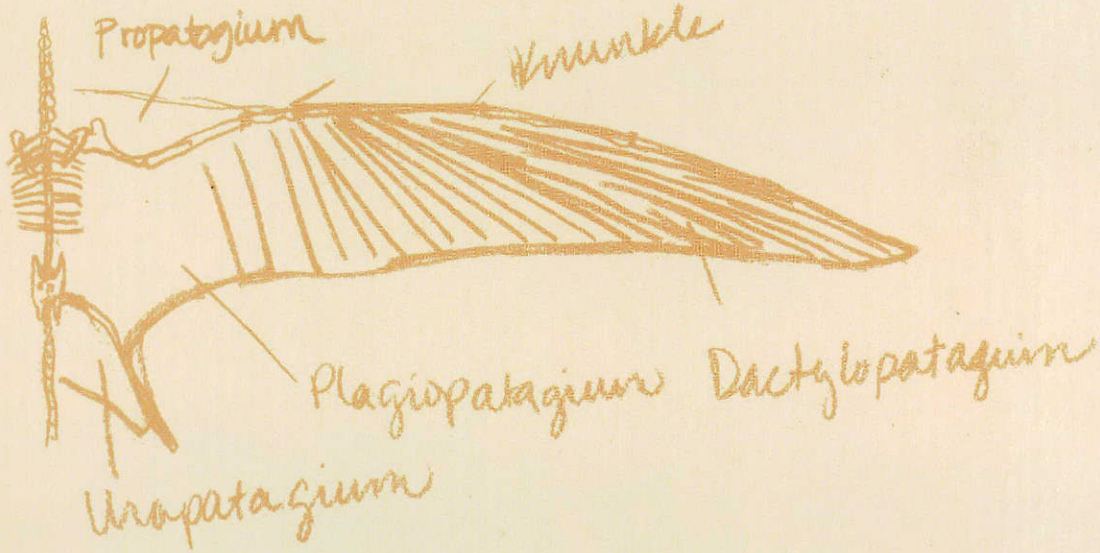
Chatterjee and his colleague, Larry Witmer of Ohio University, now are applying the same CT scan used by modern medicine on humans to study the brains of pterosaurs. Using the scan to create the virtual brain from the brain cavity in three-dimensional form, Chatterjee and Witmer are able to see for the first time how the brain of a pterosaur is structured. "The brain is the most complicated and the most amazing organ of the vertebrate body and provides information about physiology, behavior and intelligence. Simply studying the morphology of the brain, we can tell, for example, how intelligent the animal was, its head posture, and whether the animal could fly," Chatterjee notes.

Although pterosaurs have been found all over the world, scientists knew hardly anything about their brains, even though they knew about their anatomy. Pterosaur fossils generally are found in two-dimensional form, as a paper-thin sheet, because the inside of the bones are entirely hollow (necessary for flight), and become crushed under layers of time. With new finds of pterosaur fossils in China and Brazil of wholly preserved three-dimensional skulls and skeletons with intact wings, paleontologists were able to reconstruct the paper-thin wings in cross-sections. "Like any soft part of a body, such as blood and muscles, skin is fragile, delicate and normally is not preserved in fossils," Chatterjee notes. "Pterosaurs' wings are made of leathery skin, like bats, but the creatures are closer to birds than bats from an evolutionary point of view. Like birds, pterosaurs are born with hollow and very delicate bones, however the skin on their wings is reinforced by a kind of rod, called actinofibrils," Chatterjee says. "The rods in the wings indicate that pterosaurs could tuck in their wings and fold out their wings, in the same fashion that an umbrella opens and closes. Such reinforcing rods are lacking in the bat wings; this is probably why bats never became large."

Through their complex calculations, Chatterjee and Templin studied the aerodynamics, postures and brains of pterosaurs to determine whether they could hover, flap, glide or soar on their wings, as well as answer how the animals walked on land. Studying the 10 species of pterosaurs, from the smallest to the largest, the researchers examined footprints, wing designs, brains, the inner ear, stereoscoping vision, the orientation of the head, as well as environmental air patterns, or thermals, among many other factors, in determining how animals gained the ability to fly. "Throughout time many animals tried to conquer the air. The animal has to defy gravity with the use of a wing that gives the animal lift and thrust. The emergence of flight among birds and pterosaurs happened independently and separately as the different species evolved in their designs to be able to fly," Chatterjee observes. "In science, we call this convergence. In other words, in nature only a few solutions are available for a creature to achieve a goal, for example, going through water. Just one or two designs have been invented by fish to maneuver through water. That streamlined body design of fish has been copied by marine reptiles, such as plesiosaurs, and marine mammals, such as dolphins and whales."

> "Birds and their implications for human flight are intricately connected to the plate tectonics and early exploration of Antarctica, the evolution of feathers and wings in the Earth's earliest flying creatures, and the human-made aircraft designs patterned after nature and her secrets."

Citing the glories of the ancient birds and flying pterosaurs, Chatterjee reveals that the modern flying creatures that fill the skies have adapted with variance as well. For example, Canada Geese fly 5,000 miles from the North Pole to the South Pole each year in their recognizable V-formation, an economical method of sharing the force of the headwind that the flock naturally flies



toward. The Albatross, with its huge eight-foot wingspan, sails on the winds above the oceans without stopping for six to 12 months, as it snatches its food from the water and vanishes into the skies. The Loon is the only bird in the age of dinosaurs still around us, having escaped extinction for millions of years. Showing no evolutionary change, the Loon is a living fossil that first appeared in Antarctica, as suggested by Chatterjee's discovery of *Polarornis*. Their ability to fly made possible their migration to the Arctic when Penguins appeared in the south, competing for fish. Scientists have found no evidence of Loons south of the equator for the last 60 million years.

Birds and their implications for human flight are intricately connected to the plate tectonics and early exploration of Antarctica, the evolution of feathers and wings in the Earth's earliest flying creatures, and the human-made aircraft designs patterned after nature and her secrets.

On Antarctica, decades ago, Admiral Byrd named a 4,085-foot-high summit "Mount Wade" after the geologist. Among the letters that Chatterjee first found upon arrival at Texas Tech was one addressed to Wade from Wernher von Braun (1912-1977), who was one of the most important rocket developers of all time. Von Braun was searching for a secretive locale to help train the United States' earliest astronauts. Wade pointed von Braun to Antarctica.

Aware that his contributions to science may not transfer into the technology of building advanced space vehicles in his own time, Chatterjee nevertheless dreams the visions of a pioneer both in his study of the deep past and in his contributions to the far future.

Explorations of the Earth's deep crust and its ancient creatures, of Antarctica's dry desert and frozen wilderness, and of space's amazing planets and limitless frontiers are fixed in an extraordinary relationship, wrapped in the common threads of dinosaurs and discovery, completing the tapestry of Sankar Chatterjee's life.←

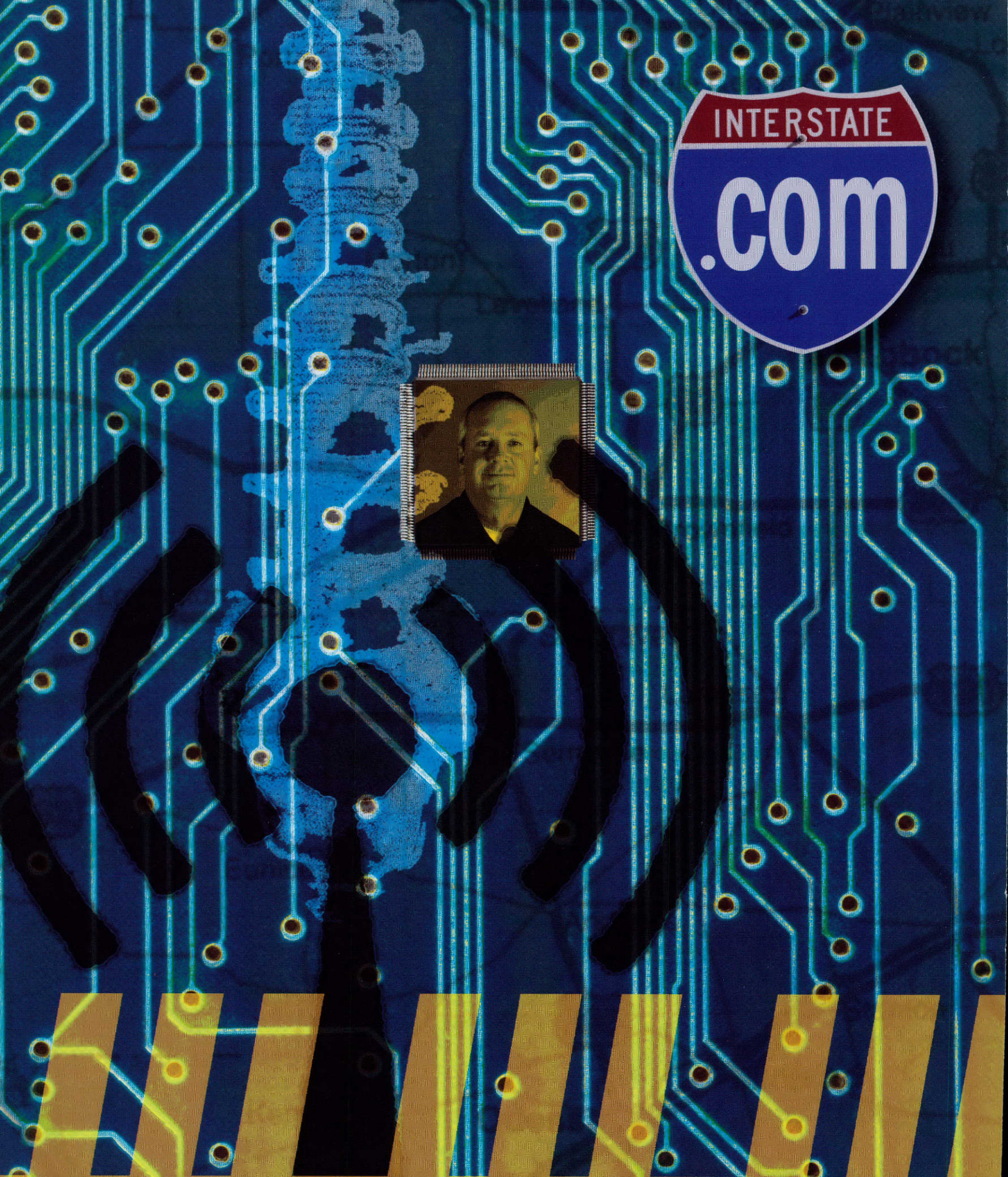

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ILLUSTRATION: JOEY HERNANDEZ & BECCA RAPIER

A Technological Backbone

By: Robert McComb, Ph.D.

A new telecommunications network built across West Texas introduces another means for Texas Tech University to contribute to the social and economic infrastructure of this region. In August 2004, the Texas Tech Office of Economic Development completed the build-out of a wireless, high-speed, regional telecommunications backbone or a communications foundation. The 50 Mbps, full-duplex backbone runs along an approximately 200-mile route from Plainview, Texas, to Hobbs, New Mexico. Along this route, the backbone passes through Littlefield, Lubbock, Levelland, Brownfield and Denver City, with an additional branch terminating in Lamesa.

Funded in large part by the Economic Development Administration (U.S. Department of Commerce) and the Lea County (New Mexico) Community Improvement Corporation, the intent of the backbone is to encourage economic development and expand educational interchange in this area. Texas Tech owns the radios and related equipment while municipal and private sector partners have donated easements on towers and structures on which the radio antennas are mounted. Thus, grants and in-kind contributions totaling nearly $1.3 million have financed this project.

A third of the backbone's capacity will be devoted to economic development uses, with another third dedicated to educational applications. The quality and reliability of videoconferencing and distance education delivery between points linked to the backbone can be enhanced greatly as a consequence of the high bandwidth and priority routing over an uncongested network. Yet, to exploit fully this asset, much work remains to be completed to build appropriate and flexible end-user interfaces and to assure the creation of valuable content and applications.

While the backbone connects to Tier I Internet in Lubbock, users along the backbone can communicate among themselves without ever having to tap the commodity Internet. In this sense, the Texas Tech University Wireless Communications Network is a wide-area-network available at no or very modest cost to the municipalities, schools, junior colleges and universities that wish to connect. Although Texas Tech will not either be reselling or be directly providing commodity Internet on this network, a path commodity Internet is available over the backbone.

In some cases, schools may wish to acquire access to Internet2. The Texas Tech transport already has enabled the Floydada Independent School District to connect to Internet2 via the university at a very reasonable cost. It should be of some interest to West Texans that these school districts would be among the first in all of Texas to bring Internet2 into the classroom. South Plains College in Levelland also will acquire Internet2 using its link to Texas Tech provided by this new network.

We have not yet started to exploit the additional opportunities for interaction between the different educational levels and locales that this network provides. Without a doubt, the colleges and schools at Texas Tech always have enjoyed significant interchange with regional partners. But new opportunities for applied research to demonstrate the effectiveness of distance delivery of innovative educational applications may be facilitated by the greatly reduced costs of high-speed interconnection that the backbone makes possible. For example, students at Texas Tech might utilize interactive videoconferencing to tutor or mentor younger students in rural settings with limited access to tutoring in science and math curricula.

Small business counseling is an extension of our educational mission. One of the first applications of the Texas Tech regional backbone will be a networked small business incubator that will tie together entrepreneurs in four communities with a business development mentor at the university. Small businesses can flourish when they are able to bring complementary external expertise and experience to their own specific skills and knowledge base. The use of videoconferencing to provide ready access to metropolitan-based business support services and a network of fellow entrepreneurs will help to mitigate spatial isolation of rural entrepreneurs and increase their likelihood of success.

Many other possibilities for the use of this backbone exist in areas such as healthcare, workforce and community development, and adult education. The backbone extends Texas Tech in a substantive way into the communities and schools in our region. ←

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SAVING VIETNAM

The black granite slabs of the Vietnam Wall stand seemingly below ground, like a long grave, and form a dark scar on the land. A remembrance of the American servicemen and women who perished during the 10-year Vietnam War, the Wall reveals the outcome for many young American troops. However, those more than 58,000 names cannot explain the complex war that continues to divide Americans over our nation's military involvement in Southeast Asia. »


THE TRUTH
WILL OUST
DOWN
WITH
PBS
DISTORTIONS

PAGE 19


PRITTEK CT&
KIPPRA HOPPER
PORTRAITS BY:
JOEY HERNANDEZ
IMAGES:
VIETNAM PROJECT

Close to the surface, those national wounds still haunt our country, and the differences of belief about the war continue to divide the generation affected by Vietnam. The wounds of America's longest war may heal, but the Vietnam generation will carry the scars forever. On the eve of the 30-year anniversary of the fall of Saigon and the end of America's involvement in the war, Vietnam lingers and reminds us of the injury, trauma, pain and grief of a historical period that will remain in our memories and national fabric forever.

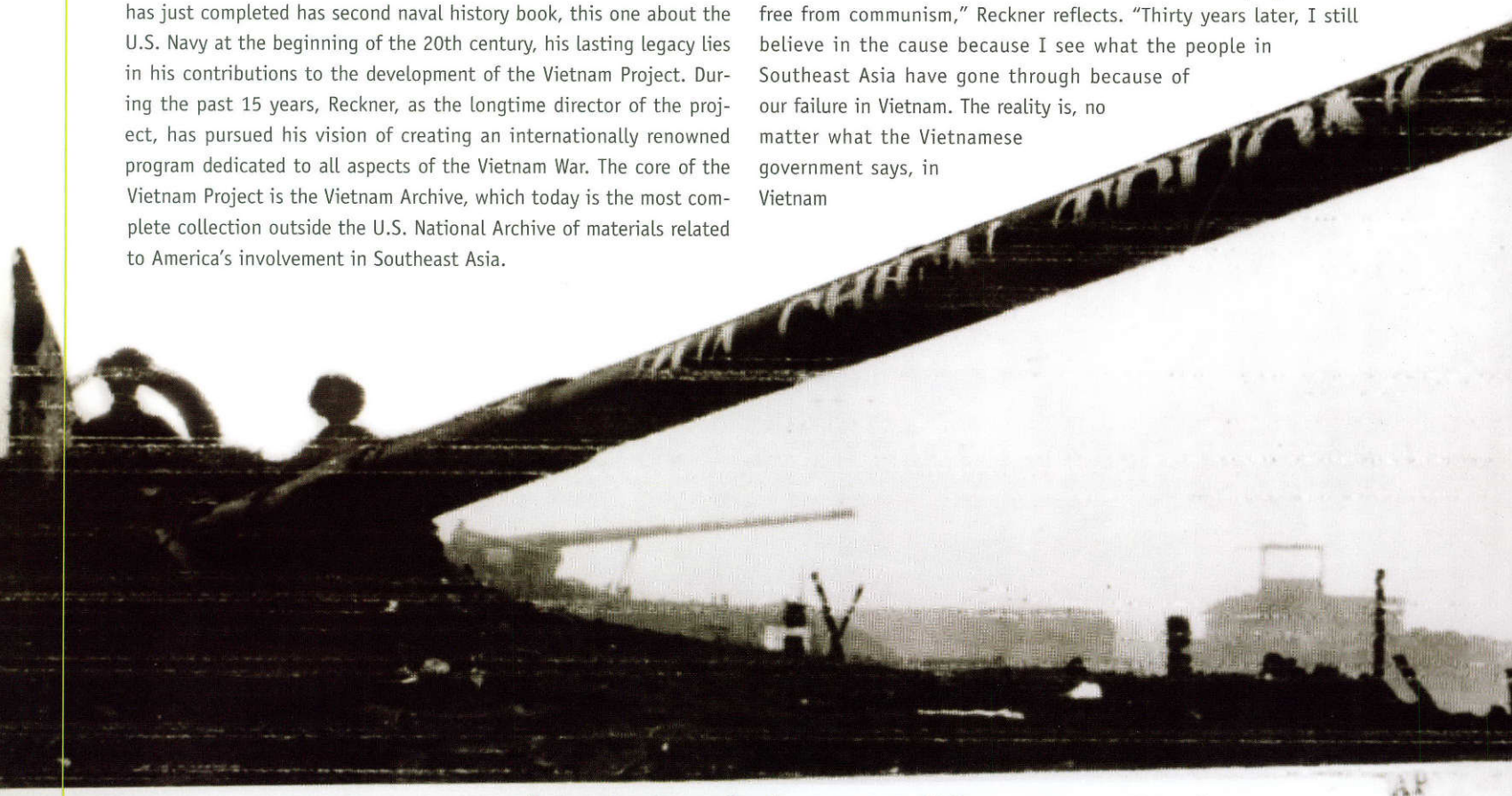
The window of opportunity to gather stories from the American troops who fought on the Vietnam battlefields is narrowing. While America's active combat involvement in Vietnam generally encompasses the years between 1965 and 1973, direct American involvement in Vietnam dates to 1945 and the presidency of Harry S. Truman. Before the passing of the generations that shaped events in those decades, scholars with Texas Tech University's Vietnam Project are fighting against time to gather as many stories and archival materials as possible about American involvement in Southeast Asia.

A combat veteran who served two tours, James Reckner, Ph.D., never imagined that his life's work would turn toward the Vietnam War when he accepted a position in 1988 in the Texas Tech University History Department. A historian of Theodore Roosevelt's Navy, Reckner had imagined disappearing into the halls of ivy, spending quiet summers researching and writing, living the life of an academic. While Reckner has just completed has second naval history book, this one about the U.S. Navy at the beginning of the 20th century, his lasting legacy lies in his contributions to the development of the Vietnam Project. During the past 15 years, Reckner, as the longtime director of the project, has pursued his vision of creating an internationally renowned program dedicated to all aspects of the Vietnam War. The core of the Vietnam Project is the Vietnam Archive, which today is the most complete collection outside the U.S. National Archive of materials related to America's involvement in Southeast Asia.

In his many years of work on the Vietnam Project, Reckner continually has observed a generation gap among the young and old. "The emotions stirred by the war remain very real for older Americans; however, they are baffling to the generation that has come of age since the war."

Reckner, who enlisted in the U.S. Navy in 1958, had his first encounter with Vietnam in November 1963 when he was a first-class petty officer in the amphibious forces assigned to the Western Pacific. Those forces arrived off the coast of Vietnam days before the assassination of South Vietnamese President Ngo Dinh Diem. The sailors were prepared to evacuate Americans from Saigon should the capital become chaotic. "When the situation stabilized after the coup d'etat, we simply sailed away, without people in the country knowing we had been there. That's the strength in having naval power close off-shore," he notes. Called "the Old Man" by troops under his command, Reckner, then a 28-year-old Navy lieutenant, returned to duty in Vietnam in 1968 and spent a year as senior adviser for a Vietnamese Navy River Assault Group in the southwest portion of South Vietnam. He then came home to spend the next 10 months doing his principal work in that day involving Soviet naval missile systems and electronic countermeasures. Again, as a lieutenant and senior adviser for a River Patrol Group, Reckner began his second tour in Vietnam in 1971, patrolling north of Saigon on the Saigon River in an area called the Iron Triangle. He left Vietnam, he thought for the last time, in April 1972.

"At the time, I believed in the cause, which was keeping a nation free from communism," Reckner reflects. "Thirty years later, I still believe in the cause because I see what the people in Southeast Asia have gone through because of our failure in Vietnam. The reality is, no matter what the Vietnamese government says, in Vietnam



VNA 338, Hanoi, April 7--One of the " Battle Kings"--long-range 175mm guns--captured by the PLAF at Tan Lam Base, Quang Tri Province (South Vietnam)./.

today, certain basic freedoms do not exist. Our failure in Vietnam and Cambodia resulted in immense suffering for the ordinary people in these countries. I still think we were right to try to prevent that. The failure was one of leadership, of faulty decisions concerning the conduct of the war, and Lyndon B. Johnson's conflicting priorities. Attempting to conduct the war in Vietnam and the War on Poverty at the same time, President Johnson ended up losing both."

Even with the archive of nearly 20 million pages of holdings, Reckner contends that a definitive explanation or understanding of the Vietnam War remains elusive. "There will never be a book that encapsulates the complete truth about the Vietnam War. It is very difficult for our generation not to be ideological, perhaps even more so for those who opposed the war, given its aftermath. Vietnam remains close to the surface in our country. It has been easy in the past to understand America's wartime involvements because the goals were clearly defined and we always have been the victors. We are gracious victors. But we never have been the losers before," he comments.

"Through the Vietnam Project, American veterans are able to deal with their past through us. In preserving all aspects of American involvement in Southeast Asia, the archive presents all sides of the war with equal vigor and care, including the anti-war movement. Our American veterans see that we preserve the records of their efforts, which have been overlooked or denigrated for many years. We finally are bringing honor and a degree of dignity to those veterans and their experiences."

The Vietnam Archive has the mission of collecting, preserving and disseminating materials related to America's involvement in Southeast Asia. The Archivist and Associate Director for the Vietnam Project, Stephen Maxner, explains that the primary focus of the archive is preserving the American veteran perspective. "We realize we have a narrow window of opportunity during which to work with those veterans. That generation is in their mid- to late-50s, 60s, 70s and some are in their 80s, so we want to work with them very specifically to collect their materials, conduct oral history interviews and basically preserve their aspect of their history of the Vietnam War," Maxner says.

Additionally, the archive has a broader mission of collecting and preserving materials that focus on the theater of Southeast Asia. "We see America's involvement in Vietnam within the context of the history of Southeast Asia as well as within the American context," Maxner explains. "We have materials dating to the 19th century, and we have newspaper collections from Indochina that date to the 1860s during the French colonial period. We consider America's involvement in Vietnam as a continuation of Western involvement in Southeast Asia. We see the Vietnam War as an event that occurred within the context of the Cold War and as part of the general U.S. military history of the 20th century, so we collect Cold War materials as well as materials that focus on World War II and the Korean War. We want to preserve all aspects and all perspectives of the war. We do not have a political agenda; our only agenda is to preserve all of the historical materials relating to the Vietnam War. We want to give everyone a fair voice to present his or her experiences of the war. With our holdings, the Vietnam Archive is very encompassing."

Working very closely with the veterans and their families, Reckner, Maxner and the archival staff are being entrusted with precious items from the individuals whose lives were most touched by the war. Donations totaling 1,500 artifacts include personal letters, diaries, autobiographies, audio letters, personal films, photographs, slides and negatives, as well as uniforms, military equipment, and some weapons. The donations eventually will be displayed at a future museum planned at Texas Tech dedicated to the Vietnam experience. "We're collecting that unique material that typically would be given to a family member and probably ultimately just would be lost or thrown away," Maxner says.

Douglas Pike Collection, 1968: Corpsman salutes as Marine raises the U.S. flag.

"It's rewarding to know that people have taken notice of the archive. They trust us with their materials. They know that we will treat them with the honor and dignity they deserve. More importantly, we make those materials available to others." Through the Virtual Vietnam Archive, anyone who has access to the Internet can find nearly 2 million pages of materials, including 73,000 photographs and more than 250,000 individual documents related to the war. "We are one of the largest, if not the largest, online archive in the United States," Maxner says. ***(www.vietnam.ttu.edu)***

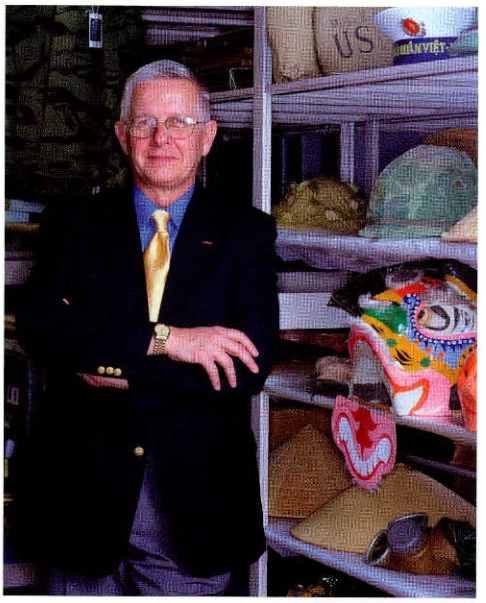
"WE FINALLY ARE BRINGING HONOR AND A DEGREE OF DIGNITY TO THOSE VETERANS AND THEIR EXPERIENCES."

With what Maxner calls the most complete microfilm collection in the nation regarding America's involvement in Southeast Asia, the Vietnam Archive collection includes presidential library materials dating back to President Truman, State Department files, national security files, captured Vietnamese military and government documents, and U.S. military records.

Helping put a face on the war, the Oral History Project of the Vietnam Archive captures the recollections of veterans' service in Southeast

Asia. "When you listen to someone talk about their experiences and what it was like to be a combat foot soldier in rice paddies, jungles and the delta, it really helps to bring the war to life. That exchange has emotion and sometimes a tragic note for what the men and women who served had experienced," Maxner comments. With more than 1,600 participants from around the globe, archivists record and transcribe the oral histories, making them available online through the Virtual Vietnam Archive. "A person's children, grandchildren and great-grandchildren will be able to listen to their veteran tell his or her own story in his or her own words. In this respect, we also are preserving family history that will be available for generations to come."

For some of the veterans, the oral history interviews are the first time they have talked about their experiences in Vietnam. "The veterans tell us up front that the interviews are cathartic and therapeutic for them. After American withdrawal from Vietnam, most veterans came home, got on with their lives and became productive citizens. They put their experiences behind them because they were not welcome to discuss them in most circles. Many did not reveal themselves as being Vietnam veterans until recent years. When they came back, they had to push their emotions back, to keep it to themselves. Now that they can openly express their feelings and thoughts, they do so willingly," Maxner says.



JAMES RECKNER HAS WORKED TIRELESSLY TO PRESERVE DOCUMENTS AND ARTIFACTS THAT REFLECT AMERICA'S INVOLVEMENT IN SOUTHEAST ASIA.

Maxner repeats Reckner's assertion about Vietnam. "For people who think they can speak in absolute terms about the Vietnam War, we provide a tremendous amount of materials, tens of thousands of pages, that reveal that we never will be able to talk about that experience in definitive terms."

Reckner's efforts to create such an impressive collection came about serendipitously in 1989 with a single question he asked freshman students in his introductory history courses. Needing to round out a nine-question survey that asked students about their general knowledge of events since 1945, Reckner composed a 10th fill-in-the-blank question asking students to name the general they most closely associated with the American involvement in Vietnam. The results stunned Reckner. He discovered that only one of the 100 students tested knew the name General William C. Westmoreland, the leading commander of the U.S. military in Vietnam. "If you didn't know the name General Westmoreland, then you didn't know anything about Vietnam. The kids knew nothing about this event that had torn America apart only 14 years earlier," says Reckner.

Disturbed by this lack of knowledge among his students, he was compelled to teach an upper-level, undergraduate research course about the Vietnam War. Finding few resources about the Vietnam War in the Texas Tech Library, Reckner convened a meeting of Lubbock-area Vietnam veterans to talk about what they might do, in a positive way, about their Vietnam experiences. From that first meeting in May 1989, the veterans launched what has become the Vietnam Project at Texas Tech. To help Reckner in his teaching efforts, the veterans immediately began collecting their own wartime materials and spreading the word for other contributions from other veterans.

The first donation came from Lubbock business owner Phil Price, who gave a box of books to the archive—his collection of the Time/Life Series on the Vietnam War. "Those books now are among tens of thousands of books in the Vietnam Archive," Reckner says. Another Vietnam veteran and, at the time a Texas Tech graduate student, Dan Siewert followed with the first archival material, the letters he had written home to his mother during his time in Vietnam. A Slaton, Texas, native, Siewert was a Navy hospital corpsman with the Marines in the northern part of South Vietnam. During a battle, Siewert was badly wounded and sent home, where he subsequently became involved with the Vietnam Veterans Against the War. "Those letters are still there in the archive, preserved. Some of the letters' envelopes are covered in mud, so those letters became both artifact and archival material," Reckner says.

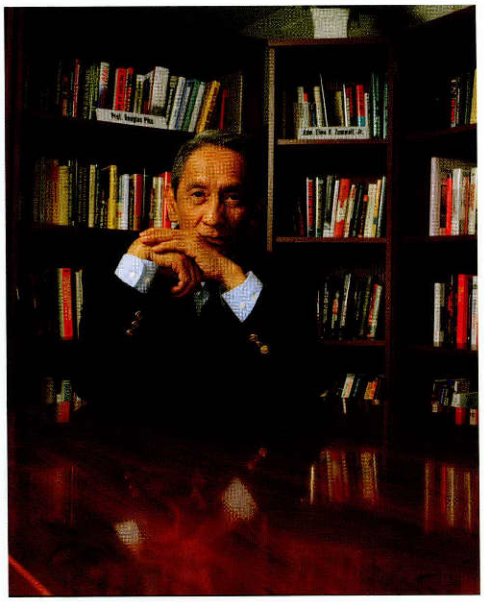
As director of the Vietnam Project, Reckner first returned to Vietnam after the war in 1998 to attend an international conference in Hanoi. With the 700 conference attendees, Reckner unintentionally ended up sitting immediately behind General Vo Nguyen Giap, the founder of the North Vietnamese army. "We met and got over it. That was the first morning of my first day back in Vietnam since the war. Such a situation would have been strange to any veteran of the Vietnam War," he recalls.

"When I later walked in downtown Saigon during that first visit back, I thought, I've become like the old Frenchman I remember sitting in front of a French restaurant near Tu Do Street in 1969. I have been OBE, overtaken by events (a military phrase). In other words, I am history," he comments. "I looked for all the bases where I had served. I saw everything, came

James Reckner Collection:
TOP: Combat Action Ribbon, Navy Unit Commendation; Navy Meritorious Unit Citation with Star in lieu of 2nd Award
BOTTOM: Meritorious Unit Commendation; Vietnam Gallantry Cross Unit Citation; Vietnam Civil Actions Unit Citation

to grips with it and wrote an essay that examined my feelings about that experience. I was searching for something. After a while, I concluded that what I really was looking for was not the Vietnam I remembered—you cannot go back there, it is gone forever—but rather that I was searching for my youth. That time in my life was dangerous but also exciting as hell, with the adrenaline pumping at the most bizarre times and with people actually trying to kill you. Then I realized what it was all about, this thing of aging and nostalgia. In the case of Vietnam veterans, we must deal with something that happened halfway around the world. For many veterans, this is difficult to come to grips with because they never really understood the war in the first place, or at least the whole context of the war. For many veterans, it is almost impossible to explain their role in a war they did not understand. Going back, I suspect, for any reflective veteran, becomes a trip of self-discovery."

One of the many tragic outcomes of the fall of Saigon in 1975 was that hundreds of thousands of South Vietnamese fled the country, many in unseaworthy boats. Many died on this dangerous passage to freedom and others endured remarkable hardships to gain the precious benefit of freedom. "The legacy for us is the presence of more than 1 million Vietnamese Americans who have greatly enriched our society. However, those who fled Vietnam paid a high price: the loss of their country, their culture and all their personal possessions in Vietnam. But they have moved forward and have achieved considerable success in their adopted land," Reckner reflects.



AMBASSADOR NGUYEN XUAN PHONG CAME TO THE UNITED STATES AFTER HIS FIVE-YEAR IMPRISONMENT BY NORTH VIETNAM AFTER THE FALL OF SAIGON.

One of those South Vietnamese who now makes his home in the United States is Nguyen Xuan Phong, a senior research associate with the Vietnam Center. Phong was a cabinet minister in the Saigon government without interruption from 1965 to 1975, working with U.S. Presidents John F. Kennedy, Lyndon B. Johnson and Richard Nixon. Phong also participated in the Paris Peace Talks in his capacity of deputy and acting head of the Saigon government delegation. Phong returned to Saigon five days before the South Vietnamese capital fell on April 30, 1975. He was at that time assuming the official duties of Minister of State in charge of negotiations and Head of the South Vietnamese Delegation at the La Celle Saint Cloud Conference. After the North Vietnamese troops took over South Vietnam, Phong was imprisoned for five years in North Vietnam because of his high-ranking positions in the Saigon government. Released in 1980, Phong remained in Vietnam under communist rule during the next 20 years before accepting an invitation to visit the United States in 2000. "Something quite amazing is that even through the prison term, the war never hurt me as much as I had thought it would, not really, because I never felt any kind of hatred for my brother enemies, especially among the numerous close relatives of my family who were on both sides of the fighting," he says.

Now 68 years old, Phong has his own explanation of the war that tore his country and the United States apart. "We don't seem to realize the magnitude of the calamity we went through. The Vietnam War is not only the longest war, but also the most confusing conflict in America's history. One of the bloodiest episodes in Vietnamese history, we fought communist rule for 30 years from 1945 to 1975, with the death estimates between 3 to 5 million in a country of about 25 million people at that time, and at least 2 million of those deaths were civilians. Roughly half the size of Texas in land area, Vietnam was the target of twice the tonnage of munitions, bombs, explosives and rockets that were used in total during World War II. It is not that the Americans did not try very hard, but it was a very confusing war for the American people during five successive American presidents. The Vietnam War was not a civil war between north and south; it was a conflict between two global opposing forces, the communist block and the free world. The conflict was internationalized as early as Harry Truman, who believed in American democracy and wanted to see a free Vietnam, free of French colonial rule and free of communist rule. With President Dwight Eisenhower and his Secretary of State John Foster Dulles, South Vietnam was viewed as an 'Outpost of the Free World' and the conflict became a bigger war within the context of the Cold War. Vietnam was not a war for the Americans to win, nor was it a war to lose in the strict sense of conventional warfare. The Americans fought in Vietnam for the ideals of freedom and democracy—concepts that were then too abstract for the Vietnamese people to comprehend. Most of them were simply motivated by a tremendous upsurge of 'nationalism' after the end of WWII and they longed to be free from foreign rule and presence after more than 100 years of French colonial occupation. Eventually, the Americans lost the battle for freedom and democracy in Vietnam, not on the battlefields but on Capitol Hill. However, in the end, America won the big war, the Cold War."

Phong observes that no one expected or really understood the kind of warfare fought by North Vietnam against South Vietnam. "From the beginning in the mid-1940s, Ho Chi Minh resorted to terrorism in a widespread and systematic manner to physically eliminate tens of thousands of individuals, groups or parties that did not accept his Marxist-Leninist leadership. Ho Chi Minh's concept of warfare was mistakenly viewed as 'guerrilla warfare' or 'subversive warfare,' but it was, in

fact, a form of 'total warfare,' which also commonly is labeled 'people's warfare' with terrorism as its main form of armed struggle. Total warfare completely refuted any conventional demarcation between civilian and military populations. "For 30 years, I said nothing about the war or its aftermath. Giving an oral history to the Vietnam Archive was my second time to speak of it," he says. "This is my third."

Within the Vietnam Project, Phong is involved with the Lessons of Vietnam project with high school students in various states, who send him questions about the war that he and American veterans answer. "The young students are very concerned, and it's a very good thing. It would be very sad if we could not help them to not go through what we had to go through, which was a very painful, chaotic episode in history."

With this same concern for teaching future generations, Reckner takes great personal pleasure in the aspects of the Vietnam Project that focus on education and outreach, not only in the United States, but also in Southeast Asia. He personally presents college scholarship monies raised through the Vietnam Project to many of the poorest students with the most promise in Vietnam and Cambodia, making the difference as to whether those individuals are able to attend college. "The innocent people of Vietnam, the children, do not understand America's fixation on what happened many years ago. They do not understand why we are so tortured when they have moved on. The young people in Vietnam and Cambodia today find themselves in the situation they are in because of our failure 30 years ago—the failure to stay the course to ensure that they would have a stable and free government. The children we help with educational scholarships in both Cambodia and Vietnam had no part in any of the events that continue to shape their lives. They are completely innocent," Reckner says. "I think we have some responsibility to that younger generation in Southeast Asia. The students will finish their educations knowing that someone in America cared enough to help them. I am a granddad, and on another level, I take great personal pleasure in interacting with these very beautiful kids. If, in the end, we pass through our lives here and do not do anything to improve the world, then what is it that we are about?" he comments.

The core missions that Reckner and his colleagues initially set for the Vietnam Center were simple: to fund and guide the development of the Vietnam Archive and to continue the study of all aspects of the American Vietnam experience. From those first veterans who gathered materials for Reckner, the Vietnam Center Advisory Board was established. Most of those original veterans who met in 1989 continue to serve on the Advisory Board today, providing valued advice and support.

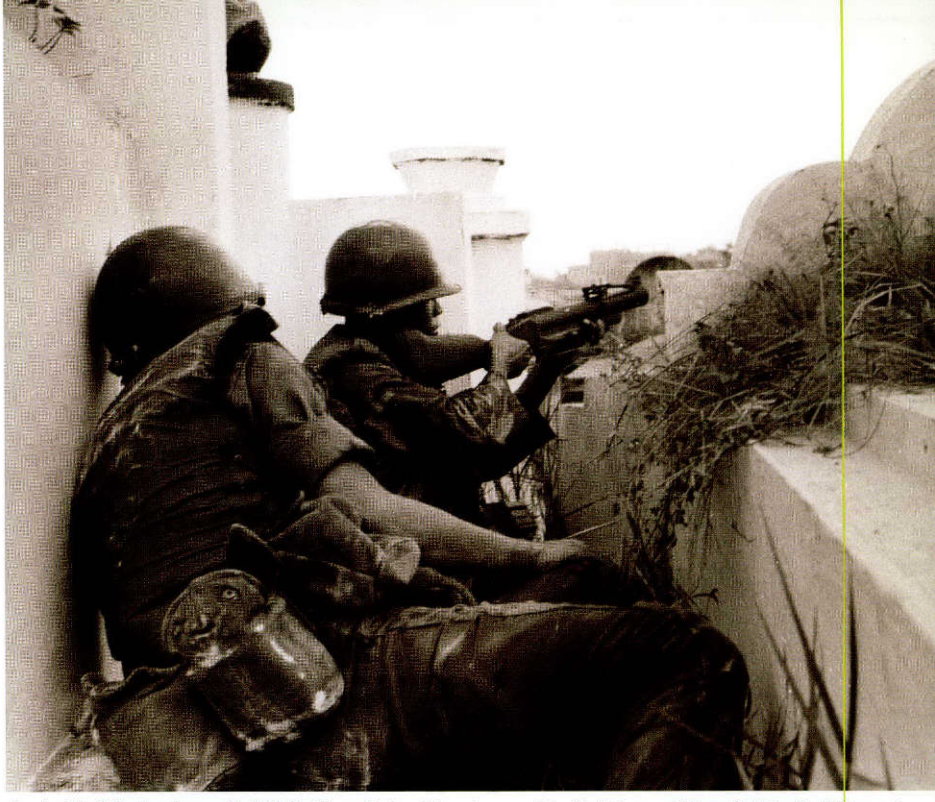
"We have stayed absolutely true to our core missions throughout the entire Vietnam Project, which now comprises the Vietnam Center, the Vietnam Archive, the Oral History Project and the Virtual Vietnam

TOP: Douglas Pike Collection, 1965: Two soldiers squatting in rice paddy. MIDDLE: 1966: Combat Taxis–"Top Tigers" of the U.S. Army's 145th Combat Aviation Battalion maneuver into the base camp landing zone to pick up combat soldiers of the 25th ARVN Infantry Division. This air mobility helped the ARVN soldiers to carry the fight into remote Viet Cong areas. BOTTOM: A task-force of 64 armed assault landing crafts were transferred to the South Vietnamese Navy in Saigon on June 25, 1967. An important transition in the accelerated American effort to shift a larger share of the military war effort to the Vietnamese Armed Forces, the transfer of equipment was valued at more than $18 million and was the largest single turnover of military equipment of the war. The assault crafts helped to maintain security and regulate river traffic in the Mekong Delta.

Archive," Reckner says. "We have received generous state support over the years, and we are conscious of that support and careful about using the money. Over the years, we have developed contacts in business, in academia, and in government throughout Vietnam and Cambodia. With the expertise developed through the Vietnam Project, we are helping to further develop the economy of the State of Texas."

Many Vietnam veterans, Reckner has discovered, are involved in humanitarian causes in the countries where they fought. Some of the interdisciplinary projects organized by the Vietnam Project have involved providing used and surplus medical equipment for hospitals and offering books for libraries and universities. In a growing project, Diane Oliver, Ph.D., deputy director of the Vietnam Center, has established a consortium of community colleges in the United States that are helping Vietnam to shape its own new system of community colleges.

In 2004, 13 Texas Tech faculty and staff members from differing disciplines traveled to Vietnam, Cambodia and Laos to look at each culture through the prism of their own academic research disciplines and to return to incorporate what they had learned into their teaching. "These trips to Vietnam show that we have a good relationship with the people of those countries," Oliver says.



Douglas Pike Collection, January 31, 1968: Viet Cong attack on Saigon troopers of the 8th Vietnamese Airborne Battalion fire M79 grenade launchers and small arms during heavy fighting with the Viet Cong in a cemetery one-half mile northeast of Saigon's Tan Son Nhut airfield.

"THE SEARING MEMORIES OF VIETNAM WILL ENSURE THAT IT REMAINS A VIVID MEMORY IN AMERICA'S COLLECTIVE CONSCIENCE."

The burden that sits heaviest on Reckner's shoulders is the fact that so many veterans have entrusted the Vietnam Project with documents and artifacts that are near and dear to their hearts. "I feel a great responsibility to ensure that the archive continues going on and is handled in the most professional way so that these precious documents will be here 100 years and more from now. The bottom line is that many veterans have donated their papers and artifacts simply because there is a veteran here in charge. No matter the collection, whether it concerns the My Lai massacre, CIA Director William Colby's papers, or the anti-war movement, those documents are in the hands of friends because we carefully preserve everything," Reckner says. "As historians we have another responsibility: to present to future generations of Americans the most balanced record possible."

During the 2004 summer, Reckner made two trips to Vietnam with several project staff members and graduate students. On the graduate student trip, Reckner and his entourage visited battlefields, religious sites, archeological digs and the Mekong Delta. Perhaps the most memorable experience for Reckner was taking his students down a canal where he spent nine months in 1969 and had not seen since. When the students visited the 1954 battle site at Dien Bien Phu, the pivotal battle of the French Indochina War, they were accompanied by a People's Army lieutenant general who had been an artillery commander at the decisive battle that sealed the fate of the French colonialists in Vietnam. The general walked the battlefield and explained the battle in detail to the students. "How do you match that kind of educational experience? I do not think in their lifetimes the students will be able to repeat such experiences," Reckner says.

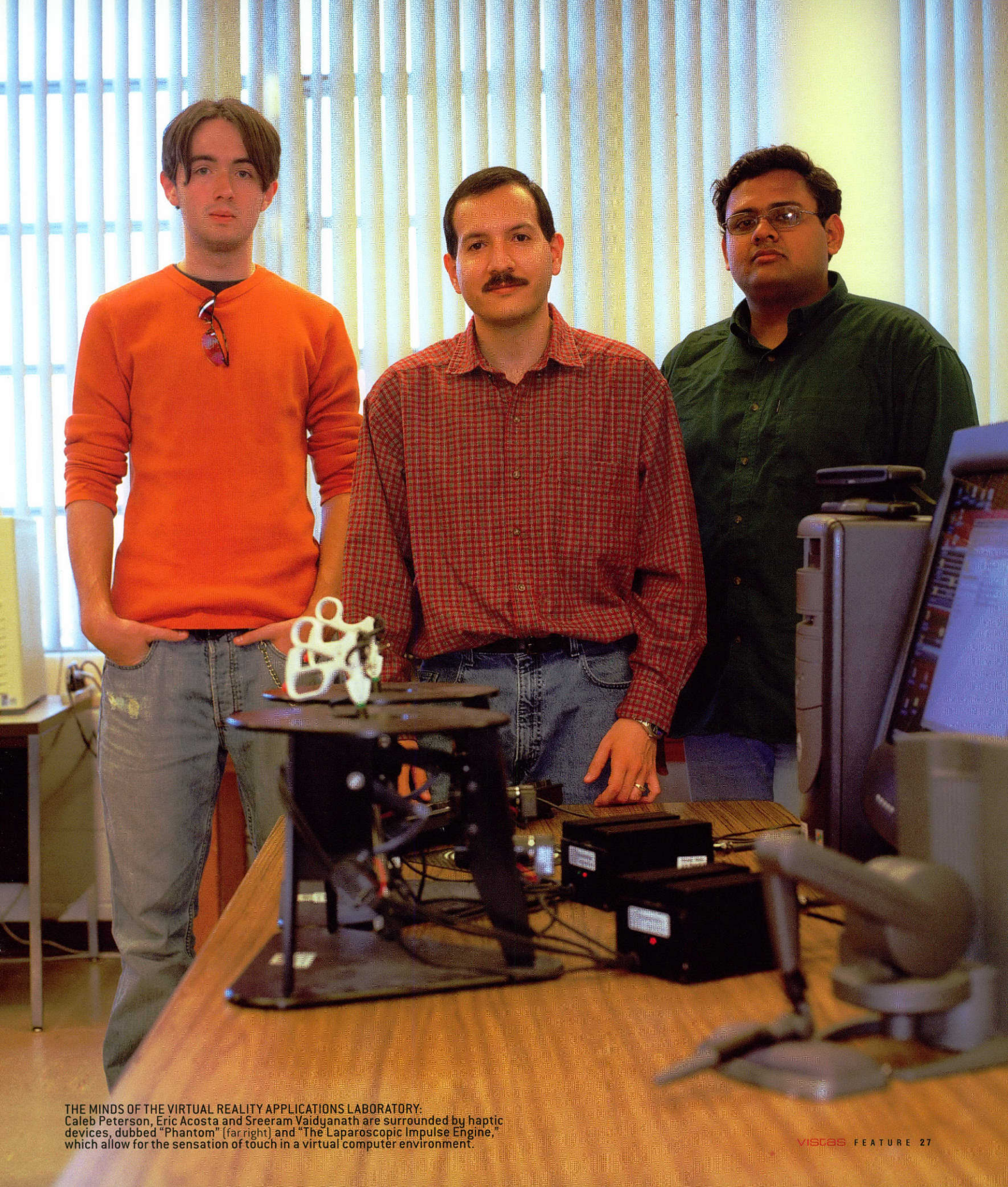
The local veterans' agenda from the beginning of the Vietnam Project was to gather archival materials and hand them over to the younger generation. "Every generation seems to have a war, unfortunately. 'Your war' is the one about which you are most emotional. Doubtless, Iraq will be this generation's war," Reckner reflects. "The searing memories of Vietnam will ensure that it remains a vivid memory in America's collective conscience. The Vietnam Archive at Texas Tech University will assist future generations in interpreting the Vietnam experience."

Telling their stories, Vietnam veterans are keys to understanding the confused and chaotic war that was fought on distant battlefields halfway across the globe. Helping the public to understand the war and continuing the dialogue about Vietnam, Reckner and the staff of the Vietnam Project are focusing on the long years of battle and wounds in Southeast Asia. Education may be the best prevention of the future tragedy of war, perhaps sparing subsequent generations from similar grief.

VIRTUAL REALITY

TEXT BY SCOTT SLEMMONS

PHOTOS BY ARTIE LIMMER & MELISSA FRAZIER

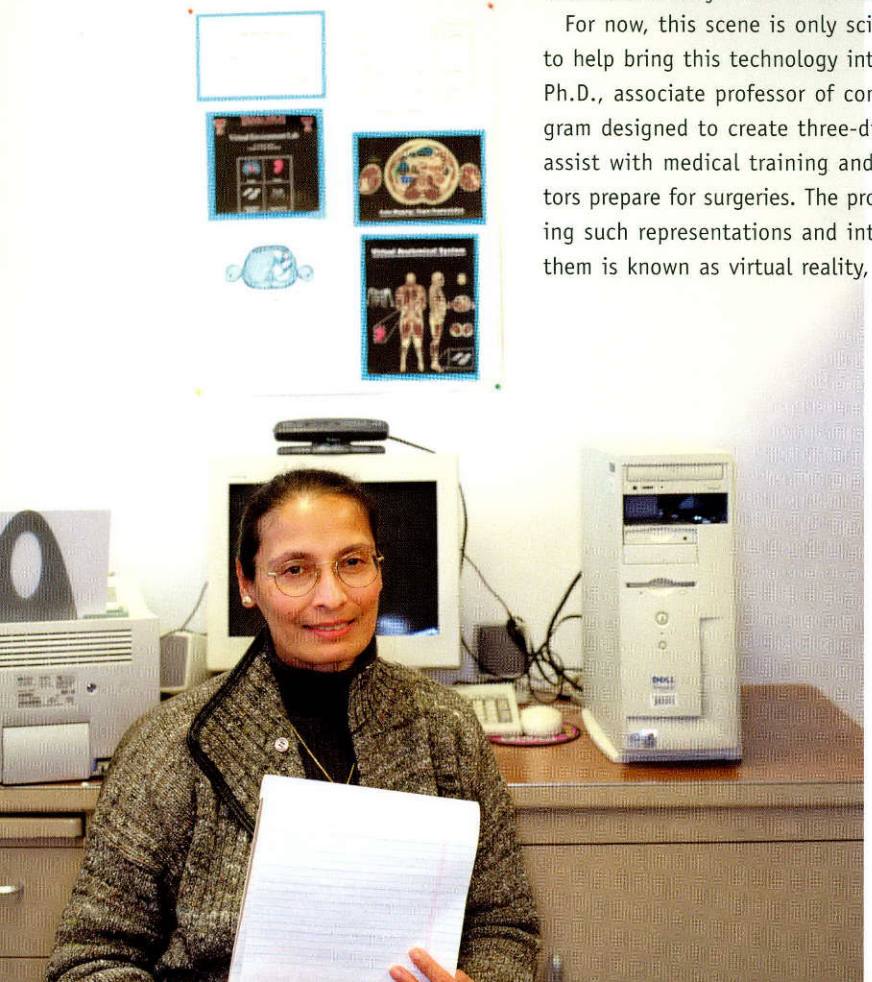


THE MINDS OF THE VIRTUAL REALITY APPLICATIONS LABORATORY: Caleb Peterson, Eric Acosta and Sreeram Vaidyanath are surrounded by haptic devices, dubbed "Phantom" (far right) and "The Laparoscopic Impulse Engine," which allow for the sensation of touch in a virtual computer environment.

Envision an emergency room sometime in the future: A patient who has suffered a brain embolism is brought in. The attending physician determines that surgery will be needed to drain the blood and relieve pressure on the brain. However, can all the lost blood be removed quickly, safely and accurately? The doctor orders an MRI scan of the patient's brain, but even this may not be precise enough to ensure there is no permanent damage to the patient. The doctor feeds the scan into a computer, punches a couple of buttons and is rewarded with a complete three-dimensional image of the patient's brain. More keys are punched, and the doctor is able to peel away layers of the virtual image to highlight all the areas of the brain where blood has hemorrhaged. The physician runs a quick walk-through tutorial of exactly what will be needed for the surgery before actually going into the operating room.

For now, this scene is only science fiction, but researchers at Texas Tech University are working to help bring this technology into existence with pioneering work in virtual reality. Bharti Temkin, Ph.D., associate professor of computer science and research professor of surgery, directs the program designed to create three-dimensional computer-based representations of the human body to assist with medical training and to help doctors prepare for surgeries. The process of creating such representations and interacting with them is known as virtual reality, or VR. In her laboratory, medical students and surgeons interact with the simulation using haptic or electronic sensing devices that replicate the sense of touch. Touch is critical in performing surgery and being able to "touch" the digital body results in a realistic experience.

"Our work has two important applications," says Temkin. "First, we want to train medical students before they perform the actual surgery. This is similar to training pilots using flight simulators. The use of a computer allows for execution of basic manipulations that can be performed and evaluated by students and teachers before the actual surgical procedures are performed. Secondly, we want to give practicing surgeons the opportunity to learn new skills and procedures unfamiliar to them. Overall, this type of system will change the fundamentals of a surgeon's training."



Researcher Bharti Tempkin directs the program to create three-dimensional computer-based representations of the human body to assist with medical training.

This haptic device allows users to reach into a virtual patient to clamp and snip blood vessels through the virtual sensation of touch in three-dimensional form.

Eric Acosta, a graduate student working toward his doctorate in computer science, has been involved with the virtual reality project since 1998. He says an important part of creating a VR surgical simulator is making sure the virtual patients are not cookie-cutter copies of each other. One should remember that details of human anatomy vary from person to person.

"What we want to be able to do is present a variety of cases," says Acosta, "something that is not commonly seen. We also can create different virtual patients for the same surgery so one can train for the same surgery, but based on different patients. We also want to be able to evaluate the surgeons and see how well they perform their tasks."

Acosta says virtual reality programs are important in giving students and doctors the ability to "touch" the computer-generated objects.

"Not only do we want to present a visual representation of the virtual world, but we want to be able to give doctors the ability to touch these objects," says Acosta. "In real life, we use the sense of touch to get a lot of information."

Virtual reality could allow doctors-in-training to learn important skills that usually must be gained by practicing on live patients.

Using a variety of haptic devices allows users to touch and interact with objects that only exist in a computer's hard drive. One of the devices of touch resembles a fountain pen attached to a mechanical arm. When moved about, the pen creates a cursor on the computer screen to indicate its position. When the cursor moves against a three-dimensional image on the screen, the pen generates resistance, allowing the user to feel all along and around the front, top, bottom, sides and even the back of the object. Several different shapes are included in the computer program, from simple geometric shapes, like spheres and cones, to letters of the alphabet, to parts of the body, including kidney and skeletal hand models.

Another haptic device allows users to reach into a virtual patient to clamp and snip blood vessels. The vessels themselves can be lifted, pulled and stretched, but not too far—too much yanking on a virtual vessel will break it. The current program does not allow for any spilling of blood if a vessel is torn, though Acosta says he is considering adding that option.

Temkin notes that virtual reality could allow doctors-in-training to learn important skills that usually must be gained by practicing on live patients.

"Most of the residents observe some surgeries but do not necessarily have first-hand experience," says Temkin."They may be looking over someone's shoulder during the surgery, or perhaps they may participate in a portion of the surgery. The real training often occurs on real patients, and one mistake can be bad. If they can practice on a virtual patient on a computer, they can learn from their mistakes without worrying about harming a real person." Continuing training also is important for practicing physicians and surgeons, who attempt to continue their training.

"Remember, the medical field is not static," Temkin says. "It's a very dynamic field. As new technology comes along, the doctors who are doing surgery now need to be trained for that new technology. They need to practice the new techniques, so if you can train them in a virtual environment, the learning is much faster and the knowledge is safer for the patient."

Virtual reality also can be used as a diagnostic tool. Acosta has created a program that can take any CT or MRI scan and convert it into three-dimensional, interactive virtual structures. "Using that information, we identify and isolate anatomical structures or organs of interest to

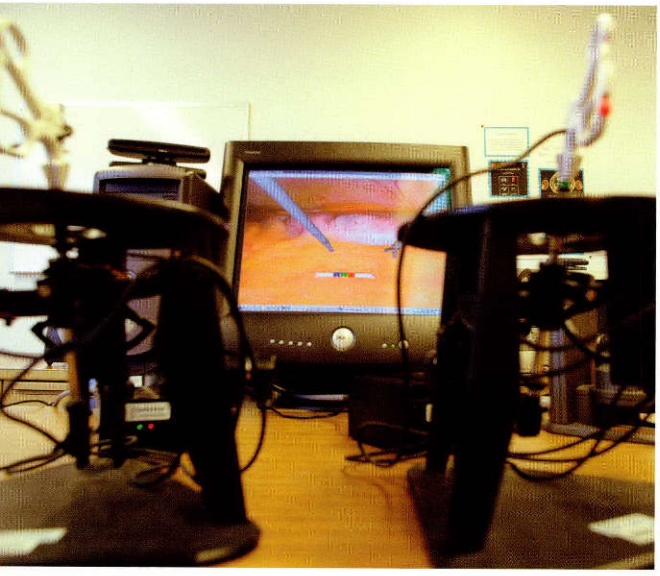
create the three-dimensional models," Temkin says.

"We want to be able to create a virtual patient," says Acosta. "One of the data sets that is becoming fairly standard is the Visible Human. This is a project from the National Library of Medicine, where researchers froze a cadaver, took CT and MRI scans, took one-millimeter slices from head to toe and came up with 1,876 slices. They took pictures of those slices, then went back and labeled all those images, pixel by pixel, as to what those structures were. Using that information, we can graph any MRI with every part of the body, every structure, every organ."

With more than a thousand structures identified and labeled, Acosta's program can locate specific structures and anatomical systems. The program also can do a three-dimensional dissection of the virtual body, from whatever view is desired. Layers of skin, muscle, fat and bone can be digitally sliced away to give a surgeon a better look of problem areas.

"Our basic goal is to allow the surgeon to review the whole procedure in virtual reality before surgery is done on a patient," says Temkin. "What the doctor will be able to do is look at the patient's specific anatomical anomalies, then choreograph the whole procedure with the virtual reality simulation, so when the surgery is performed, it is very efficient and the surgeon knows exactly what needs to be done. We want to create an application-programming interface so the surgeon can create a plug-and-play situation. For example, the surgeon can say, 'I'm doing gall bladder surgery on Patient X. I'm having a problem with only one piece of the surgery, and the rest of it I know.' There is no reason for the surgeon to go through an application where he or she has to do everything repeatedly. The doctors can build a new application when they want it, where they want it, how they want it, and they can practice exactly what they want."

With the virtual reality components, it's very important that the underlying technology be continuously redefined.



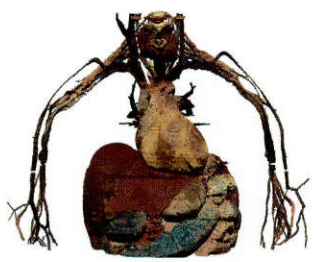
Behind the haptic devices that allow for the virtual sensation of touch is the computer screen showing virtual surgical instruments that are controlled by the mechanical haptic devices.

"In surgeries where doctors are separating Siamese twins, for example, the decisions doctors make are very critical. If we get a simulator that's very realistic, doctors look at the specific case in virtual reality and compare what the outcomes will be if they make certain decisions," Acosta says. "So the medical professionals can approximate the outcome before anything is done."

Acosta says that the system is being developed with the aid of the Texas Tech University Health Sciences Center's Department of Surgery, which has enabled the computer science department researchers to expand their thinking beyond the numbers of ones and zeroes of computer programming.

"As we develop these systems, we're interested in feedback," says Acosta. "We come from a computer science point of view, and the surgeons come from a medical point of view. Therefore, it is important that we take the doctors' view and our view and come up with something that will work. Many systems are being developed. You have someone who is very good with computers trying to develop this, but in the end, it may

THE VIRTUAL HUMAN, showing below the anatomy of the thorax region, with consecutive removals of layers of skin, connective tissue, the muscular system, the skeletal system, the respiratory system, and the organs. Haptic devices allow for the building of three-dimensional structures by dissecting human anatomy.



not suit the needs of the medical community. By collaborating and interacting with the medical community, we are able to get that important feedback to make sure we stay on the right track and create a system that will benefit everybody."

While great strides have been made in virtual reality in the last few years, Temkin says more work still needs to be done before the technology will be useful for actual human surgery.

"What you see is an approximation of what needs to be done, and the question becomes how good is this approximation?" Temkin says. "The question of how close to reality we can come technically still is to be answered. With the virtual reality components, it's very important that the underlying technology be continuously redefined, a very important point."

Running her hand from a small stack of papers on her desk to the surface of the desk itself, Temkin explains, "The possible range of the sense of touch, or the resolution of touch, means that if I continually touch something made of one kind of material and then touch a similar kind of material, how much of a difference does there need to be between these two materials before I notice that they are different and not the same material. It is important that these haptic devices have a very fine resolution of touch, but at the moment, it is still very coarse. A human hand can tell the difference between the feel of the top of a wooden desk and a sheet of paper, but a computer cannot necessarily tell the difference. That technology is more on a mechanical engineering level, where the mechanics of the device itself will change. The second technology is computer science. Any software is prone to errors, so can the software technology also be taken to the level where we can eliminate as many errors as possible?"

Despite the challenges, Temkin and Acosta believe that the future is bright for virtual reality, thanks to technology and programming that have been developed at Texas Tech.

"One of the things Eric did for his master's thesis was a program called 'Graphics to Haptics,'" says Temkin. "Before his work, you could create a graphics environment, in other words, a three-dimensional environment in which you can rotate an object, scale it, and cut through it. However, if you wanted to make the environment touchable, you had to take the time to reprogram the application itself. With Eric's program, you have to do no additional programming. If you have a graphics environment, you can say, 'Make it touchable,' and it does, with one punch of a button. That is exactly the sort of program that surgeons will need so they can do the work themselves, instead of relying on us.

"We always have to keep the future in mind," says Temkin. "As technology changes, we have to be very dynamic; in our lab, all the software is dynamic. We design our software in such a way that it can be changed with minimum additional effort. A surgeon should be able to choreograph the tasks and the skills that are needed to create an application only when required, and not rely on some fixed application that always does the same thing."

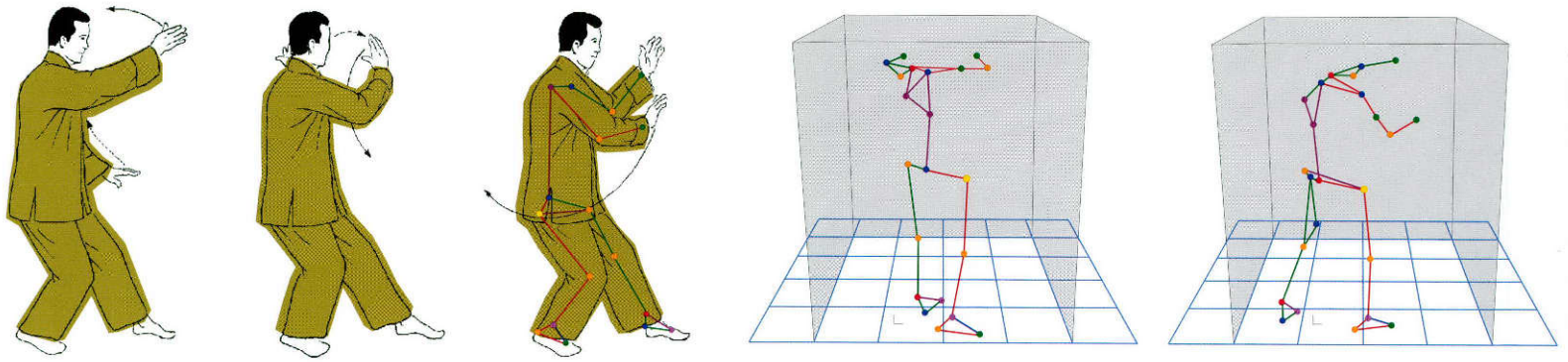
Pioneering work in virtual reality, Temkin and her team of researchers are creating a future of possibilities to apply to probabilities. ←

WORKERS' REVOLUTION

story by kippra d. hopper

photos by artie limmer

Tai Chi, Chinese characters, and natural human rhythms are fascinating inspirations for Simon Hsiang, Ph.D., who uses his cultural and academic backgrounds to study human movement. A native of Taipei, Taiwan, and an industrial engineer, Hsiang is researching the movements and sub-movements especially of workers in material-handling jobs in which lifting is required, often resulting in lower back pain and injuries. In any industrial setting in the United States, lower back pain is the No. 1 reason for workers' compensation claims. While the modern United States economy is overall service-oriented, Hsiang is interested in distribution center jobs, which historically are preceded by assembly lines where lifting and loading creates stresses and strains on various joints. The repetitive jobs are the human price for doing the work. >



Assembly lines began in the United States first in slaughterhouses, where workers would take on various individual tasks required for processing meat. Henry Ford and the building of his Model T started an evolution in the United States economy toward more assembly line work, in which the motion and time of all jobs were standardized.

After interviewing generations of Detroit automobile assembly line workers, Hsiang learned that the workers stood for hours doing the same tedious tasks with the same repeated motions. They hated their jobs because they felt that they became part of the machine and were owned by the machine's pace. Now, 100 years after those first assembly lines developed, less than 10 percent of the jobs in the United States are manufacturing-related with such production methods. Today's distribution center jobs require such assembly methods in packaging, labeling and sending products to consumers but are not standardized as past jobs were.

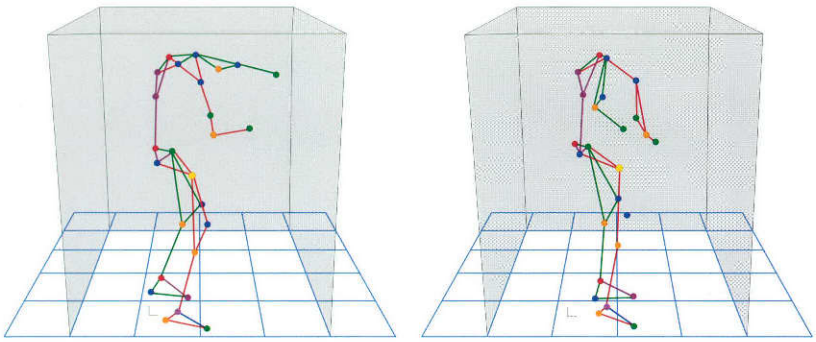
An example of a distribution center is seen in the methods used to build and distribute computers, made of various and different components. With a national debate taking place regarding the outsourcing of jobs from workers in the United States to cheaper laborers in other countries, Hsiang points out that United States distribution center jobs never will be outsourced because of their necessity for today's e-commerce and deconsolidated supply chains. In the United States, the numbers of distribution centers are increasing. In the global economy, various components are made in various countries and then are assembled together to make a final product. The gathering of these components and the distribution of final products require distribution center work, which, Hsiang says, carries with it inventory and scheduling nightmares. A theme seen in advertising and a basic tenet of industrial engineering is the idea that on-time performance is everything.

"Beyond scheduling and inventory issues, in this entire process, a very big problem exists in determining how to pay workers for such varied job tasks and how to charge customers for products that are similar but not always identical, such as is the case with computers or PC markets," he says. "We need to figure out how to allow people reasonable ways to maintain production and performance, making the workplace more flexible and humane."

With an avatar, which is a computer-generated human dummy or mannequin on screen, Hsiang is documenting and quantifying human movement by simulating particular job tasks. "Obviously, a way exists to calibrate and to document how people move or how people work." Attempting to coordinate the different motions and patterns involved in human movement to his own avatar, Hsiang first borrowed from two ancient activities of his native culture, the writing of Chinese characters and the practice of Tai Chi, an Asian martial art.

Showing the delicately written Chinese characters, Hsiang explains, "Every Chinese character is done by stroke, a motion pattern done in two-dimensional fashion through three-dimensional coordination. In calligraphy, or writing by hand, a certain order exists: the writing always is done left to right, always top to bottom and always with a structural order that is based on our anatomy. If I am a right-handed person, pulling something left to right allows me to see the character at the same time I am writing it. I would say the same things about our motion patterns. If I have my first steps start from the left, most likely I will turn to the right, all based on functional anatomy and motor intelligence."

Tai Chi, a long practiced Chinese martial art, emphasizes certain sequences or routines in movement. Tai Chi is based on balance at the core, or the idea of yin/yang. "Through Tai Chi practice, one can achieve smooth body movement from the inside out. In Tai Chi, there is a core, or very simple guideline, that organizes body coordination. Chi is the energy source, something hard to define mathematically. However, through Newtonian physics, a Western idea, we can determine a mathematical expression of postural balance and movement elegance, which combines an Eastern philosophy with the Western notion of efficiency to create a formula that describes how we move and work. The mixture becomes an intelligent motion coding system. Using the coding system, whoever reads calligraphy of motion patterns can visualize the choreography of Tai Chi. We use these two strategies, along with the biomechanical optimizations of human movement, to create software that basically shows humans' movement and sub-move-



Simon Hsiang coordinates human motion patterns with his computer-generated avatars. Hsiang, born in Taipei, Taiwan, borrows from an ancient activity of his native culture, Tai Chi. The Chinese martial art empahsizes smooth and balanced body movements, which he replicates in the avatars seen above.

ment and for controlling or designing the avatar's movement," Hsiang explains. "Every job becomes a set of animations of how people work."

Combining these ergonomic measurements with the knowledge that humans also experience biological rhythms, such as circadian rhythms or women's and men's cyclical physical changes, Hsiang emphasizes that these functions affect work satisfaction and production.

"We would like to create a model that will show us how people fluctuate and how distribution centers can accommodate and take advantage of those changes. If I take the difference over time, I see two interesting behaviors. When a person feels jumpy in their performance cycle, the jumpy performances go together. And, when a person is in a stable state of their cycle, the stable parts go together," Hsiang says. "In other words, packages change day by day, but the frame of reference and variation of a worker who is performing certain jobs stays auto-correlated, or history-dependent."

Hsiang can measure combinations of factors, such as error rates, shipping mistakes and overall productivity, by measuring the worker's contributions through scanning time of bar codes on the packages, and then he can find a reasonable combination to accommodate the fluctuations of the individuals.

"For example, after finding a worker is sore and his or her dexterity is affected, I can rotate that worker to a different task or when a worker is in an especially productive mood, I can assign a particularly important job," Hsiang says.

In coming up with this mixture of Eastern and Western thought to solve an industrial engineering and ergonomic problem, Hsiang says he began realizing that he should look at people not based on an average. "There are no average people, and there are no average performances, so we're looking at a higher order of statistics, which reflects that we are human. People fluctuate. Jobs fluctuate. Now I can find a way to let the fluctuations move in the same rhythm to achieve the best outcome, one of which is to decrease workplace injuries and workers' compensation claims."

an Economic Generator

BY ROBERT M. SWEAZY, PH.D., P.E.
PORTRAIT BY ARTIE LIMMER

IN WEST TEXAS, GROWTH RATES of population and personal income lag behind the rest of Texas and the United States. If the area is to remain economically viable, a new economy must emerge. As one of the most important economic assets in the entire region, Texas Tech University must be involved with developing this new economy. While not attempting to define the new economy's composition, it is apparent that two resources, energy and water, must be readily available as foundation and cornerstone. Beyond sustaining our current economic activities, abundant and affordable energy and water are essential to achieve higher rates of economic growth and diversification of the West Texas economy. Redevelopment of these two natural resources will allow West Texas to gain a comparative, regional economic advantage that will encourage and attract new business and investment. In many parts of the country, water is used to produce energy via hydroelectric generation; but in this region, energy is used to produce water. Texas Tech University is proposing that the first step in the economic redevelopment of the region is to develop and utilize the abundant wind resources of the Southern Plains to generate electric power for a variety of purposes—including pumping and desalinating the vast reserves of brackish water that lie beneath the Ogallala Aquifer. Simply redeveloping our wind and water resources will enhance the regional economy. Currently the region is energy-constrained by a lack of transmission facilities. By constructing clusters of six to eight 1.5 megawatt wind turbines, the capability to generate 9-12 megawatts of electricity per cluster is provided. By need siting the clusters, the necessity for high voltage transmission lines is obviated. Erection of the wind turbines will create temporary jobs, but the structures themselves will represent huge, relatively permanent increases in the property tax base of small rural counties of about $9 million-$12 million of taxable assets for each cluster. Similar economic gains will accrue from the water production and desalination facilities necessary to redevelop the water resource. Such activity is possible with existing technology but will require cooperation and interaction between federal and state government, the private sector and higher education. While all three entities will be engaged in all facets of development and implementation, each will have a primary role. Federal and state government must initiate the process with start-up funding, appropriate policies and political support. The national labs will bring invaluable scientific and engineering resources that will continue to improve and lower the cost of both wind energy and water desalination technologies. The university will be responsible for ensuring economic and technical feasibility, proof of concept, and conducting research aimed at continued improvement of the process. This will include low-wind speed environment testing and design: both keys to adapting to the unusual weather characteristics of our region compared to California and Western Europe where design and manufacturing now occur. Also, colleges and universities will educate and train the technicians, meteorologists and managers necessary for process maintenance and operation. The private sector's charge will be to commercialize the technology utilizing its entrepreneurial spirit and manufacturing, marketing and financial expertise. In the end, only private capital can drive a successful, market-oriented deployment of these emerging technologies and spawn the industry clusters that will ensue. Once we have collectively assured adequate energy and water resources for sustainable regional growth well into this new century, we can proceed with confidence to create the jobs and new sources of wealth that will expand opportunity and enhance the quality of life for all. ←

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VISTAS **CAMPUS SCENES**

The Marsha Sharp Center for Student Athletes recognizes the academic achievements of Texas Tech athletes. "Coach Marsha Sharp, who was instrumental in the establishment of the facility, and the Lady Raiders long have been outstanding ambassadors for Texas Tech," says President Jon Whitmore. "This center not only demonstrates our dedication to academics, but also allows us to show our appreciation to Coach Sharp for her more than two decades of service to the university." Sharp and her individual team members take pride in their outstanding graduation rates.

MELISSA FRAZIER

{EDITOR'S NOTE: Thank you to the readers of VISTAS and to the Texas Tech faculty for the privilege of telling their magnificent stories. Kippra D. Hopper, M.A., *(Editor, VISTAS, 1991-2005)*. The story goes on...}

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