WINTER 2007
Asia/Pacific – Summer 2007

BOSS

CONNECTING TO INDUSTRY

Notes from Under-ground

Building tunnels involves engineering expertise and perseverance

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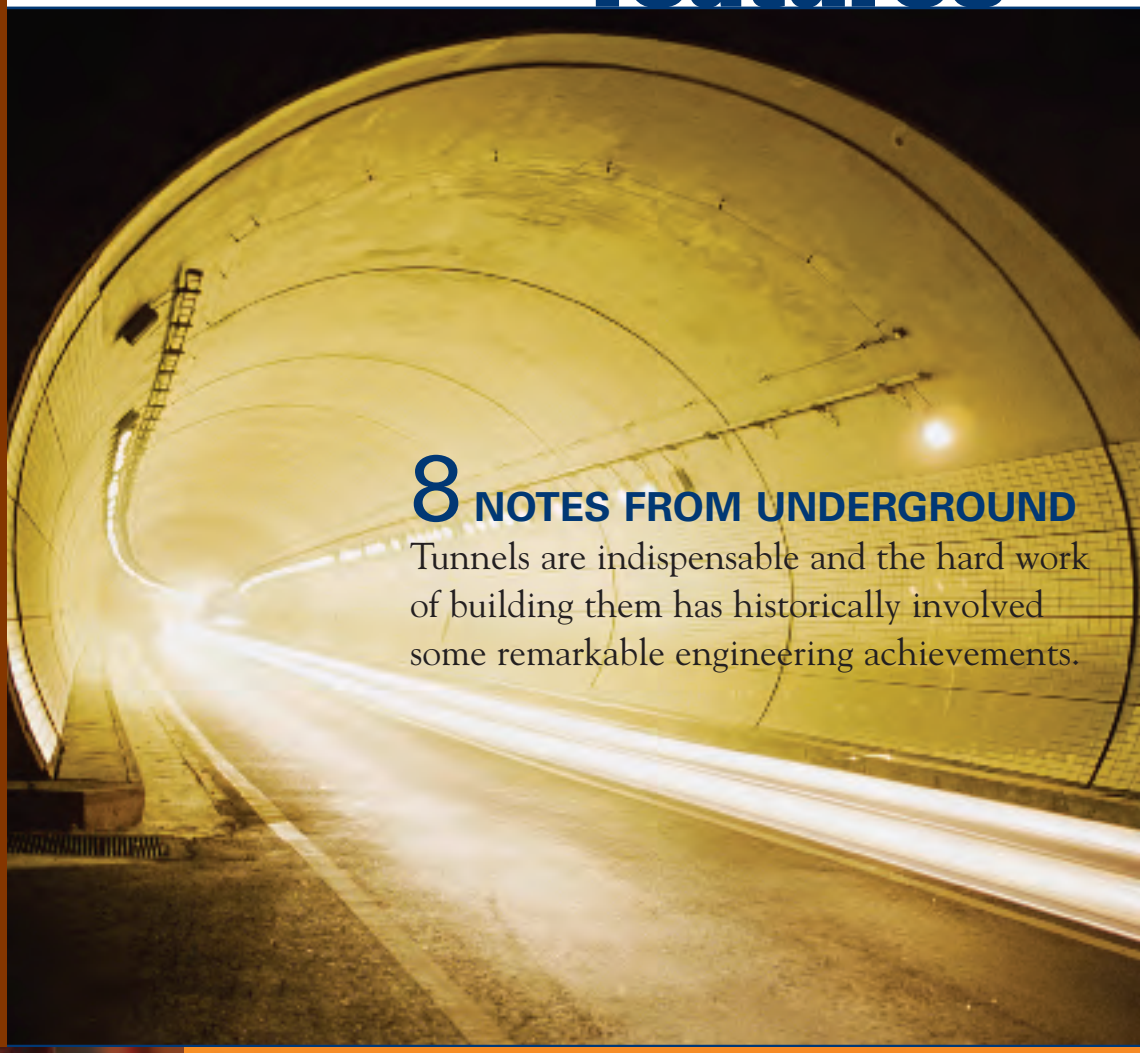

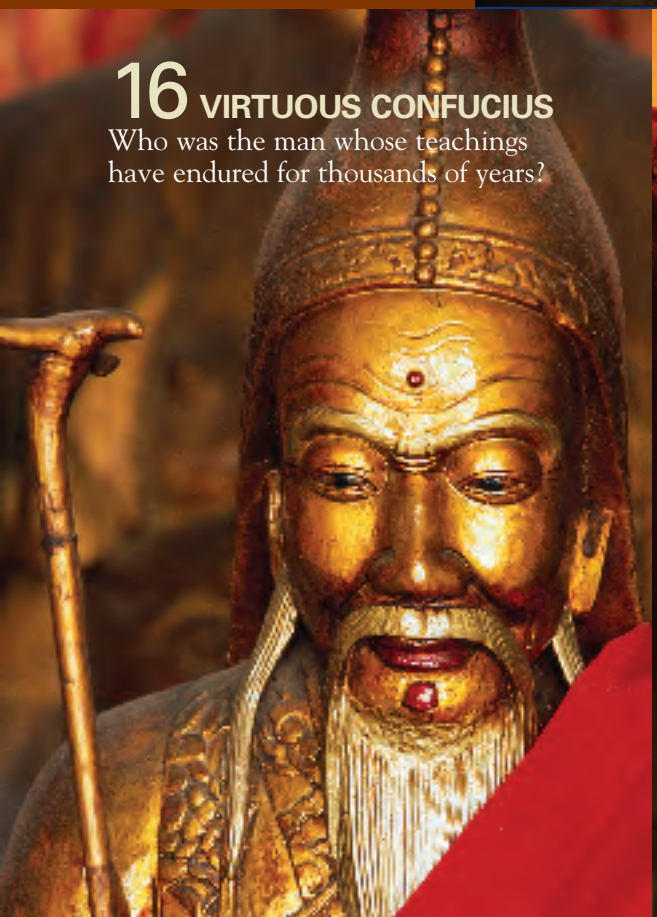

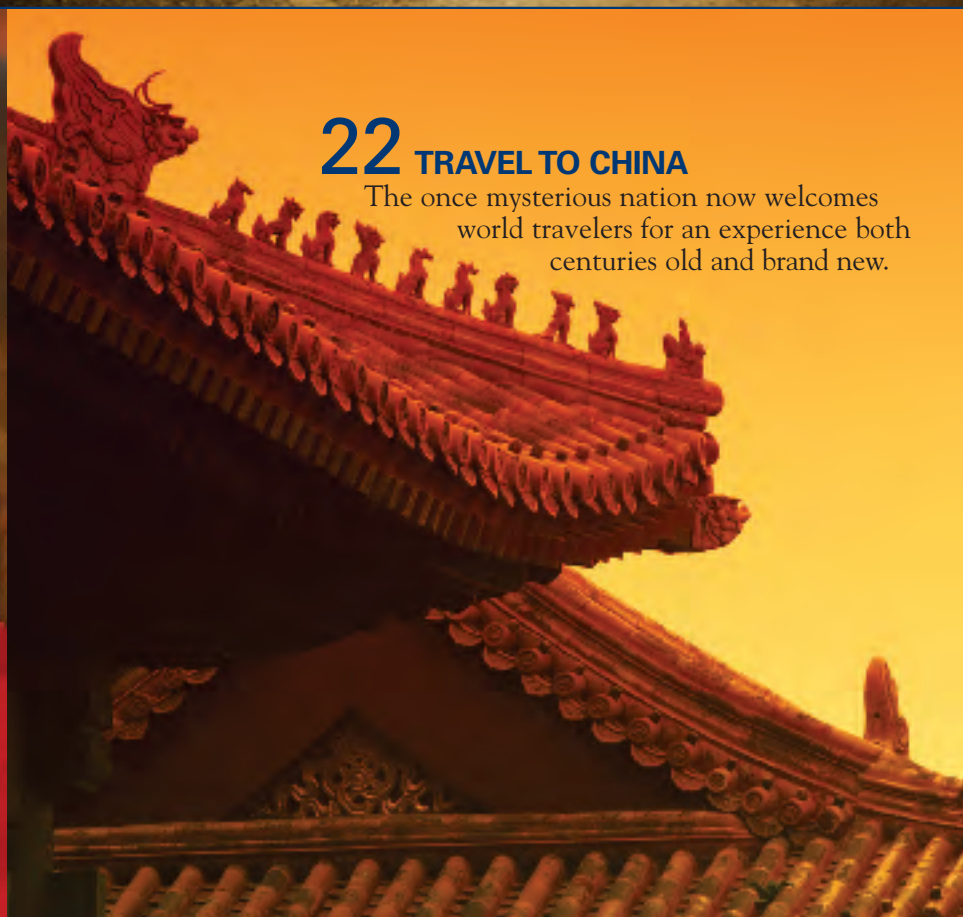

Take the Shot

Wayne Gretzky, the ice hockey great, once said, "I never made any shot I didn't take." The message is clear. You don't succeed without taking a chance. To go one step further, however, I believe that you don't succeed without preparing to do so.

In Gretzky's case, preparation included physical conditioning, hours of skills development and knowing his opponents. He took a chance and his best shot when he had the opportunity because he was ready. We all know that Gretzky did not make a goal every time he shot, but we do know he was so well prepared for the shots he did take that he had a fantastic hockey career.

Being good at business is like being a successful athlete. You must be prepared and take the shot when the opportunity presents itself. Preparation is about having quality employees who know the market and are willing and able to provide what the customer wants where and when it's needed. Over the years, Dixon has been blessed with very talented, well-prepared people. They stay focused on serving the customer. When the opportunity to offer more products or services presents itself, our folks step in, take a chance and do their best. The results are great customer service, more product offerings and continued growth. All of this happens because we are prepared and willing to do what needs to be done. We take our best shot.

Please enjoy our magazine and thank you for your business.

Dick Goodall

BOSS

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President Andrew Jackson

Meager beginnings led to courageous decisions from a self-made man

BY SUE DE PASQUALE

The American people had spoken, and Andrew Jackson had heard them, loud and clear.

Voted the seventh president of the United States in 1828 in a landslide victory over John Quincy Adams, the Tennessee senator who inspired the term "self-made man" opened wide the doors of the White House for the "people's inaugural." Thousands swarmed into the executive mansion. In the once-elegant East Room, where Jackson had wisely installed 20 spittoons, the crowd smashed china and crystal while scrambling for refreshments.

It was a fitting start for the founder of the Democratic Party. Jackson's guiding credo was: "The people are the sovereign power. The officers are their agents." During his two terms, the tall, skinny, white-haired former general charted a new course for the modern presidency, vastly expanding its scope. He exercised his veto power 12 times (more than all his predecessors combined) and helped invent the political convention as a method for nominating presidential candidates.

The first president born poor, Jackson grew up on the frontier at the border of North and South Carolina. His father died before Andrew was born. At 13, Andrew signed on as a mounted orderly in the Revolutionary War. His brother Hugh died in battle and Andrew and his brother Robert were taken prisoner. When at one point Andrew refused to clean the boots of a British officer, the man slashed him with a saber, cutting his arm to the bone and gashing his face—and Robert's, too. Both boys soon after contracted smallpox and Robert died. Elizabeth Jackson brought her only surviving son home, where he recovered. But within months she too died, of plague, while tending to sick relatives aboard a British prison ship. "I felt utterly alone," Andrew would later recall.

These early trials imbued in Andrew Jackson an abiding ambition and a lifelong toughness. (His nickname "Old Hickory" derived from those who described him in battle as "tough as hickory.") A "roaring, rollicking" young fellow, he headed to North Carolina to learn the law and eventually landed in Tennessee, where he rose to become a major general in the state militia, a Superior Court judge and the state's first U.S. congressman.

After a brief early stint in the War of 1812, Jackson directed a brutally successful campaign to exterminate the Creek Indians. When the war shifted south, he was tapped to lead the Americans against the British in the Battle of New Orleans. After the smoke cleared, the casualty tally was absurdly lopsided. Americans killed or injured: 71. British: 2,037. General Jackson emerged a national hero, his ascendancy to the presidency seemingly preordained.

Jackson lost an extremely close election to John Quincy Adams in 1824, but came back in 1828 to capture America's

highest office by a 4-1 popular margin. Sadly, his beloved wife, Rachel, died a few months before his inauguration.

One of Jackson's biggest challenges as president came to be known as the "nullification crisis." When Vice President John C. Calhoun proposed that his state of South Carolina annul the federal cotton tariff (and later advocated secession), Jackson's response was swift: He threatened to send in federal troops, with the proclamation: "Disunion by armed force is treason. Are you ready to incur its guilt?" The nullifiers backed down and a token compromise tariff was passed.

A second issue that engaged Jackson was his opposition to the increasingly corrupt Bank of the United States—what he disparaged as the "hydra-headed beast." He wanted to democratize the American economy, giving smaller banks a chance to take hold. But the federal bank remained deeply entrenched, largely by offering cheap loans to influence-wielding politicians. In a show of executive power, Jackson vetoed the bank's early recharter, a move that set a permanent new course for America's economy, according to some historians. With three years left in the bank's charter, he later ordered the withdrawal of all federal deposits. The action earned him a "resolution of censure" from the Senate—a step never taken before or since. The censure was later officially expunged.

After leaving office, Jackson returned home to his beloved plantation in Tennessee, "the Hermitage," in 1837, where he lived with his adopted son, Andrew Jackson Jr. (With no children of their own, he and Rachel had adopted their orphaned nephew as a child.)

The "people's president" died eight years later at age 78, leaving behind an executive branch that had been transformed by a man unwilling to bow to influence. "It is possible that friends are overawed by power," Jackson had once written. "It cannot overawe me."

Notes from Underground

Story by Jim Duffy

Tunnels are indispensable to our modern networks of trade, commerce and transportation. From ancient times to the modern day, the hard work of building them has involved some remarkable engineering achievements.

It's easy to take tunnels for granted. They're such an everyday part of modern life, allowing people and goods to move through mountains and under water in cars, trucks, trains and subways. But as anyone who has ever worked on a tunnel construction project knows, building safe and functional passages underwater or underground is a highly complex affair, requiring both the brute force of heavy construction machinery and the pinpoint precision available through high-tech survey and geological equipment.

Ancient Tunneling

It's not a job for amateurs unschooled in the ways of modern science. So put yourself in the sandals of Eupalinos, the enterprising Greek engineer who lived on the island of Samos in the sixth century B.C. Ruled by the notorious tyrant Polycrates, the island featured an imposing fortress, easy to defend save for one glaring weakness —the possibility that a long siege might succeed if enemies were able to cut off the supply of inland fresh water to the island's populated coastline.

Polycrates assigned Eupalinos to fix this homeland security glitch. The problem was, the solution involved digging a 4,000-foot-long conduit straight through a mountain of solid limestone. Eupalinos had to tackle this job without surveying instruments, magnetic compasses and topographic maps. Needless to say, explosives and power tools were not at hand. In fact, his ancient world didn't even have much in the way of basic mathematics.

It sounds like mission impossible, and yet the Tunnel of Eupalinos is there on Samos for tourists to see today. It's not the world's first tunnel, considering that Egyptians and Babylonians had dug out earlier ones. But there is an air of mystery about Eupalinos' tunnel; it's been a source of great fascination for scientists and historians over the centuries.

Engineering Mystery

"No one knows exactly how he did it," concedes Tom Apostol, a retired mathematician from Caltech. Apostol is among the small army of modern-day minds who've tried to figure out how Eupalinos might have managed to establish and maintain a straight line that could be followed underground through solid rock by two crews working from opposite ends of the project while keeping to a precise elevation at all times. Numerous scientists have tried and failed over the centuries to put aside their modern tools and replicate the level of precision Eupalinos achieved.

Apostol and a Caltech colleague, Mamikon Mnatsakanian, have offered a new possible solution. In a 2004 article for *Engineering & Science*, a quarterly magazine put out by Caltech, they propose that Eupalinos erected a 23-foot-tall tower atop the mountain he was tunneling through in order to gain clear sight lines in both directions down to the sea. With that perspective on his elevation, he could have used a simple sighting tool that consists basically of a pair of 2-meter poles with thin, equally weighted strings attached to the ends.

Taking careful measures along one small segment at a time, this strategy theoretically would achieve something approaching the precision of Eupalinos' tunnel. In the end, at the point where his two crews of enslaved workers met, they were within just 23 inches of each other in elevation.

"This represents an engineering achievement of the first magnitude," Apostol writes.

The Tunnel of Eupalinos on the Greek Island of Samos, above, is an ancient engineering marvel, spanning more than 1,200 meters (4,000 feet) through the island's mountains.

Digging Big

Needless to say, modern-day tunneling works a little bit differently than it did when Eupalinos pulled off the feat that made him famous. But that doesn't mean that ingenuity and creativity aren't still the keys to meeting the engineering challenges at hand. Consider the case of Boston's $15 billion Big Dig project. Now mostly completed, the controversial project was undertaken in the late 1980s in response to a civic conundrum of the first order. The city's Central Artery, an elevated six-lane highway that was then 30 years old, had become one of the United States' most clogged and dangerous roadways. Traffic projections for 2010 envisioned tie-ups lasting 16 hours every weekday. Similar problems plagued a pair of tunnels under the Boston Harbor. The solution involved replacing the Central Artery with an eight- to 10-lane underground highway directly below the old elevated route and adding a new four-lane tunnel under South Boston and the Boston Harbor to link city traffic with Logan International Airport.

Actual construction work on the Big Dig stretched on for 15 years, and the project was mired in controversy for

Troubles on the Big Dig

Boston's Big Dig has been dogged by criticism and controversy almost from the first day of construction. Initial projections put a $2.6 billion price tag on the project, but the final cost came in at more than five times that amount, nearly $15 billion. The state of Massachusetts has filed several lawsuits in recent years against contractors over these cost overruns.

The controversies multiplied once the Big Dig actually opened to traffic. In early 2004, icy road conditions forced the temporary closure of one new tunnel. A few months later, gushing water forced the temporary closure of another.

This past July, the Big Dig's problems took a tragic turn when concrete ceiling tiles collapsed in the Ted Williams Tunnel on Interstate 90, killing a 38-year-old woman traveling with her husband en route to Logan International Airport. The accident sparked a project-wide safety examination that uncovered numerous problems with other ceiling tiles.The Massachusetts Turnpike Authority has estimated the bill for repairs will reach $15 million.

In November, the Massachusetts Attorney General filed a multimillion dollar lawsuit charging a dozen different companies involved in management, construction, design, and oversight of the tunnel work with negligence. One of those companies, project manager Bechtel/Parsons Brinckerhoff, faces the more serious charge of gross negligence in the suit. In August, the family of the woman who died in the accident filed a wrongful death suit against many of the same companies. In addition, a grand jury has been convened to determine whether any companies or individuals will face criminal charges in the case.

Ways and Means

There are countless ways to build a tunnel. Among the most notable are:

- Cut and cover, in which a trench is dug then covered over with beams or other supports used to hold up the roof.
- Tunnel shields, in which excavation is advanced by pushing tube-shaped devices through underground surfaces cleared through blasting.
- Tunnel-boring machines, which automate the tunnel-digging process, are like giant drills with shield-shaped cylindrical tips.
- In the New Austrian tunneling method, the natural geological forces at work in rock and soil formations surrounding the project are carefully integrated into the design of a tunnel support structure.
- Immersed tubes are underwater tunneling's version of manufactured housing. Tunnel pieces constructed off site are dropped into a waterway and then welded together. The best-known American examples are New York's 63rd Street Tunnel and San Francisco's Transbay Tube.

much of that time (see sidebar page 11). The logistics of doing this job in the midst of a major city going about its daily business were mind-boggling. Perhaps the most daunting challenge of all was figuring out a way to keep the old elevated highway up and carrying nearly 200,000 vehicles a day while work crews dug an enormous hole in the ground directly below it.

That's why the Big Dig involved the largest use of slurry walls ever undertaken in North America. These are basically concrete walls that run from the ground down to bedrock. They take their name from the mix of clay and water that's pumped into a man-made trench to hold the sides of the walls in place until concrete is poured in. In Boston, clamshell excavators and continuous milling machines were employed to cut a 3-foot trench down to bedrock, which lies as far as 120 feet below the ground in some places. Reinforcing steel beams were dropped into the slurry-filled trench before concrete was poured in.

Completed in 10-foot-long segments—or "panels"—covering more than five miles in all, these would become the walls of the new underground Central Artery. But the slurry walls tackled two other tasks along the way. First, they produced a stable work area for excavation, something that would usually involve much wider, sloping slurry walls. Second, the entire weight of the old elevated highway was shifted onto them so that workers could remove the footings supporting the beams under the highway.

Another imposing challenge arose in downtown Boston at Dewey Square, where four lanes of a new underground roadway would have to pass under a subway tunnel. This crossing came at the lowest point of the Big Dig—120 feet below the surface. In addition, transit authorities were planning to add a new tunnel for an electric bus line serving Dewey Square. Slurry walls were out of the question this time, as it would have been impossible to cut one straight through a subway line and a tunnel. In addition, there was the issue of how to dig a tunnel in such a way that the subway line above it wouldn't settle and damage the train tracks. Here, the engineers employed a strategy called "underpinning," supporting the subway by inserting underneath it a reinforced concrete table resting on bedrock.

The Big Dig encountered a different sort of problem while tunneling under the Fort Point Channel to create a nine-lane highway. In building the old Ted Williams Tunnel, Boston had successfully dropped steel tunnel sections—each longer than a football field—into an underwater trench. These sections were barged into Boston by water, but a pair of existing bridges en route to Fort Point hang too low over the water for such barges to get through.

Here, Big Dig engineers opted for something that had

never been tried in the United States before—concrete tunnel sections. Because these sections had to be fabricated close to the site to avoid the problem with the bridges, Big Dig engineers decided to build their own "casting basin." They excavated some 450,000 cubic yards of dirt to make a dry dock area big enough to hold an aircraft carrier—1,000 feet long, 300 feet wide and 60 feet deep.

Much of this dry dock actually sat below the waterline inside the channel, but the work area was kept dry by the construction of temporary watertight barriers, or cofferdams, filled with crushed stone. Once the tunnel sections were built, these cofferdams were removed, flooding the basin and allowing the tunnel sections to be floated out into the channel and then lowered into the trench. All 27 feet high, the sections were as long as 414 feet and as wide as 174 feet apiece. The heaviest weighed more than 50,000 tons.

That's a lot of weight, considering that the city's Red Line subway runs under the new tunnel. Here, Big Dig planners opted to drill 110 concrete shafts down as much as 145 feet into bedrock. The plan was to keep weight off the subway by sitting the tunnel on the shafts. The first few tunnel sections were floated out early in the year 2000. Then the cofferdams were reinstalled and the casting basin reopened so that more sections could be built. The last two sections were dropped in June of 2001.

Long-term Plans

In the works for two decades now, the Big Dig seems a never-ending affair to many Bostonians. But judging by historical standards of tunnel building, it hasn't taken that long. It was back in the early 1800s when British engineer Mark Isambard Brunel decided that the time had come to carve a route for pedestrians and carriages to cross under the Thames River in London.

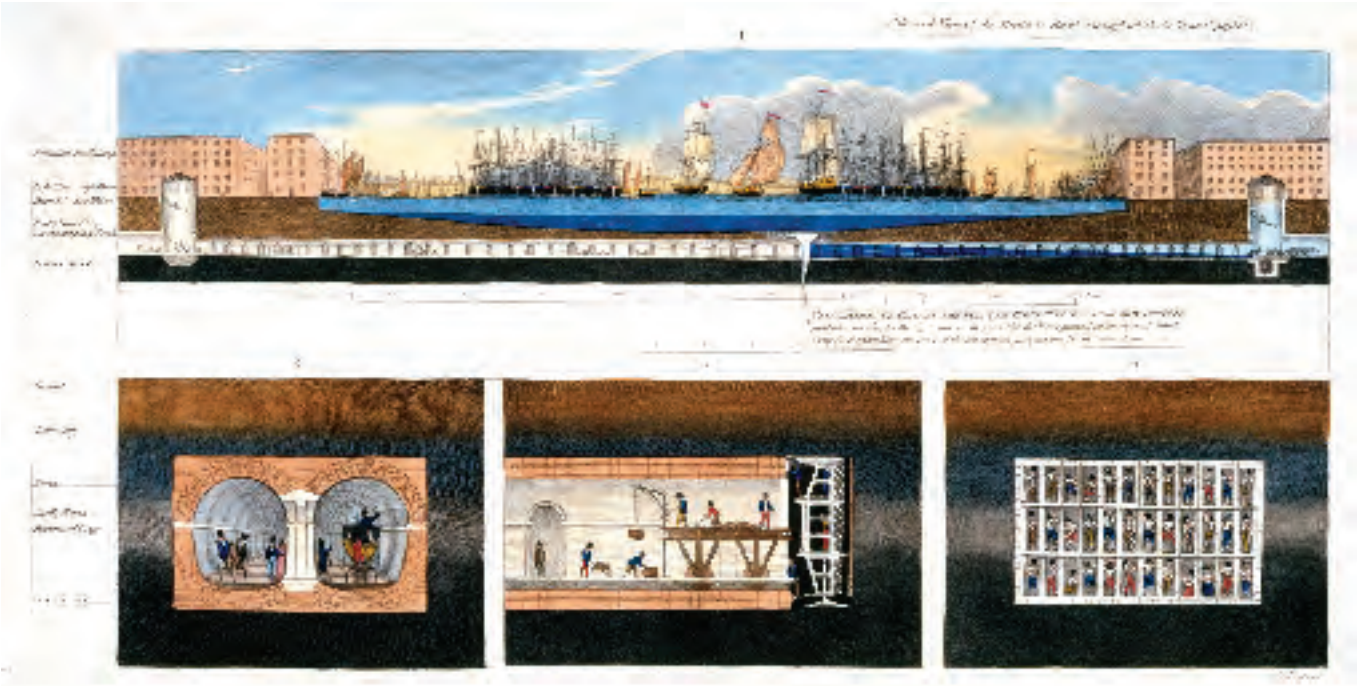
Brunel wasn't the first to propose such a project, but he was without a doubt the first to gain his key moment of inspiration for how to accomplish it while studying a tiny shipworm bore into an oak plank.

These creatures were what inspired him to create the first "tunnel shield." Powered by the muscles of workingmen, Brunel's version of the shield looked like a giant tin can with one end removed altogether and the other end punctured with a small hole. The shield went into service in 1825 on what was supposed to be a three-year project. Opening ceremonies were actually held 18 years later, after all manner of leaks, collapses and other delays.

To make matters worse, the Thames Tunnel was a financial bust at first, in part because the city declined to put in proper entrance and exit routes for carriages, leaving only penny-a-head pedestrians as paying customers. But, eventually, in 1865, it became part of the London Underground and remains in service today.

As impressive as Brunel's achievement was, it pales next to another 19th-century job—the Mont-Cenis Tunnel through the Alps at the border between Italy and France. The project

First envisioned in the early 1800s, the Thames Tunnel, below, took more than 18 years to build using tunnel shields.



was unprecedented: blasting and digging a seven-mile hole through the base of a mountain. Early estimates put the likely time frame of the job at 40 years, but the work picked up pace soon after its 1857 inception thanks to three inventions.

First, University of Geneva scientist Daniel Colladon came up with a way to effectively transport steam power deep into a tunnel, opening up the possibility of mechanical drills. Then, such a drill was actually developed by a team led by Germain Sommeiller, who went on to become the chief engineer on the Mont-Cenis project.

The third major breakthrough came courtesy of the Swedish chemist Alfred Nobel and his discoveries about using nitroglycerin as a blasting agent. The arrival of dynamite meant that fewer and smaller blasting holes needed to be drilled than with the old black gunpowder. In addition, dynamite creates much less smoke than powder, a boon to workers who previously could barely see where they were working amid the dark haze that hung, constantly, in the tunnel.

Two crews worked from opposite ends of the tunnel, meeting 13 years later, on December 26, 1870. Tragically, the engineers on the first three trains that tried to run through the tunnel's incline were overcome by fumes created by their own steam engines—two died of asphyxiation. This crisis was solved with the arrival of imported "smoke-consuming" engines developed for the London Underground, and the tunnel formally opened in September 1871.

Also called the Frejus Rail Tunnel, the route through Mont-Cenis was twice as long as any other tunnel in the world on the day it opened. Obviously, this represents something other than an incremental advance in human achievement. Slow and steady isn't always how things go in engineering and tunneling. Whether in ancient Greece, industrial Europe or modern-day America, dramatic advances can come in sudden and surprising bursts. You never know what's going to happen when engineers get together with construction teams to solve a problem that's never been solved before.

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For information about Dixon products, please e-mail BOSS@dixonvalve.com.

Crossing the Channel at Last

The Channel Tunnel connecting England and France is probably the world's most famous tunnel, even if its renown isn't related to any notable engineering feats. As the historian Joseph Gies has pointed out, building the "Chunnel" was in some ways an easier job than getting under the Hudson River in New York City.

But the Channel Tunnel's completion in 1994 represented the realization of a dream that had captured human imaginations for centuries. The first proposal to make a passable route under the English Channel dates to 1802 and was followed by countless other plans.

Some of these were downright silly—one envisioned a picket-fence-like row of vents rising out of the sea to feed fresh air down into the tunnel. But many others were workable designs that fell victim to political or financial complications. France and England finally agreed to undertake the project in 1984.

Over the next decade, some 15,000 workers tackled the work of building three tunnels, two for trains and one for maintenance. Eleven tunnel-boring machines were used in the work, each serving as a sort of mobile excavation factory able to drill holes and remove debris. In all, more than 10 million cubic yards of soil were removed from the bottom of the Channel.

The maintenance passage was the first of the tunnels completed. When British and French crews working from opposite shores and employing the latest in laser survey techniques met on May 22, 1991, the centerlines of the two sides of this tunnel were separated by just 14.1 inches horizontally and 2.3 inches vertically.

Tunnels By the Numbers:

The **Seikan Tunnel**, the world's longest, is a rail route that links the Japanese islands of Honshu and Hokkaido under the Tsugaru Strait over a distance of 33.5 miles—two miles longer than the Channel Tunnel between England and France. Construction at Seikan began in 1971 in response to dire forecasts of traffic levels expected to overwhelm an existing ferry system. Completed in 1985, Seikan is widely regarded as an engineering marvel, but those forecasts were off the mark. Only 1.7 million passengers travel the tunnel every year—less than the old ferry system once served. The project cost $3.6 billion.

The **Gotthard Base Tunnel** now being built in Switzerland for railroad traffic will extend for 36 miles under the Alps. It's scheduled for completion in 2015.

China's just-finished **Wushaoling Tunnel** is the sixth longest rail tunnel in the world, at nearly 13 miles.

The longest tunnel in North America is the 9-mile-long **Mount Macdonald Tunnel** through the Selkirk Mountains in the Canadian Province of British Columbia.

Though it's only 1.5 miles long, the **Lincoln Tunnel** under the Hudson River between New York and New Jersey ranks among the world's busiest vehicular tunnels, carrying 120,000 cars and trucks a day. It was among the targets eyed by Islamic terrorists in a failed 1993 plot to destroy a series of New York City landmarks.

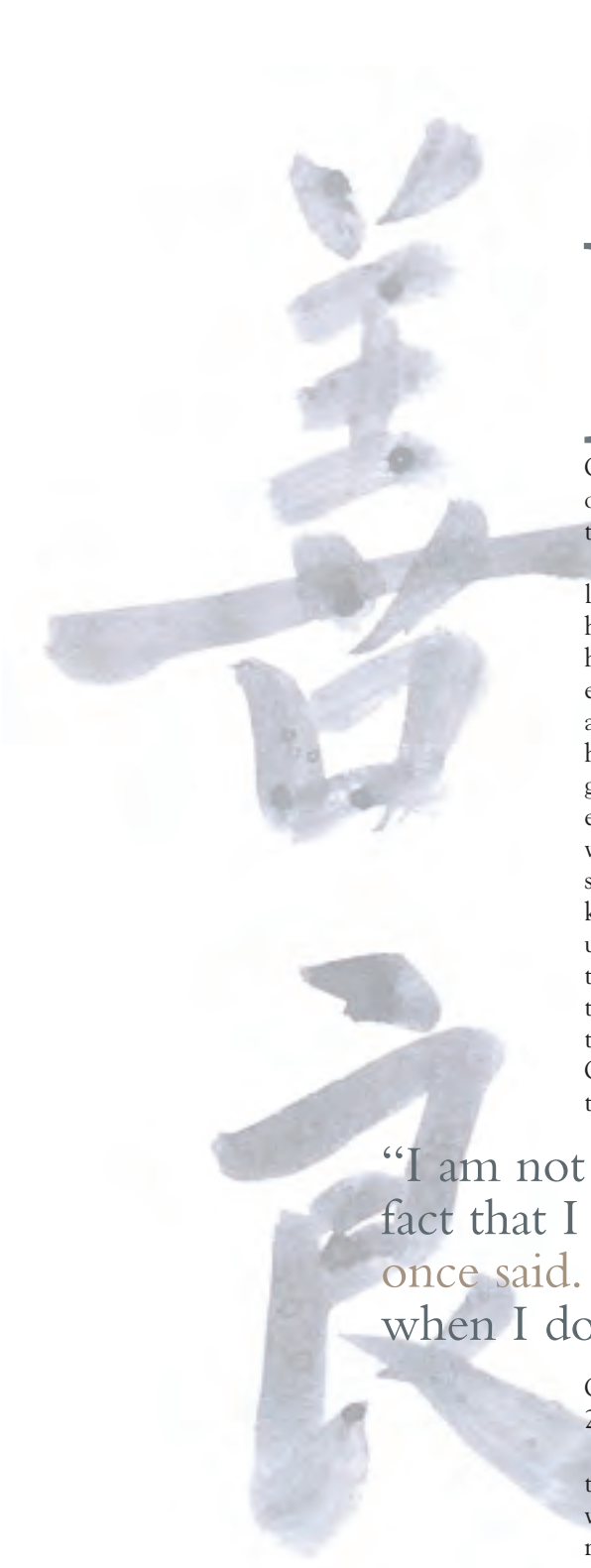
The longest vehicular tunnel in the world is the **Laerdal** in Aurland, Norway, at 15 miles.

Upon its completion, currently scheduled for 2007, China's **Zhongnanshan Tunnel** will move into second place for vehicular tunnels at 11.2 miles.

Virtuous Confucius

BY Sue De Pasquale

LEGEND HAS IT that on the night before Confucius was born, his 15-year-old mother went into a cave and prayed for a son. The Black Emperor deity appeared to her and granted her wish. Just to make sure, she returned to the cave the next day to give birth—in fact she had to rush to get there in time. She baptized her new son with water from the cave's warm spring.



From this humble beginning sprang a child who would go on to become one of the foremost Chinese thinkers. A political reformer, teacher and philosopher, Confucius inspired a universal system of ethics and morality that has survived the test of time.

Confucius founded a school of philosophy known as the Ru school, which holds that people should strive to live harmoniously to create a society founded on virtue. For Confucius, the sum of all virtues was considered to be "ren" or human heartedness, benevolence or goodness—best practiced by loving others. He connected this concept closely with "shu" or reciprocity, which he summed up by what has come to be known as the "Silver Rule": "Do not do unto others what you would not have them do unto you." Though he claimed to be merely a transmitter of wisdom that he gleaned from antiquity, Confucius, in fact, originated many of the core ideas that would sustain Chinese civilization for more than 2,000 years.

"I am not bothered by the fact that I am unknown," he once said. "I am bothered when I do not know others."

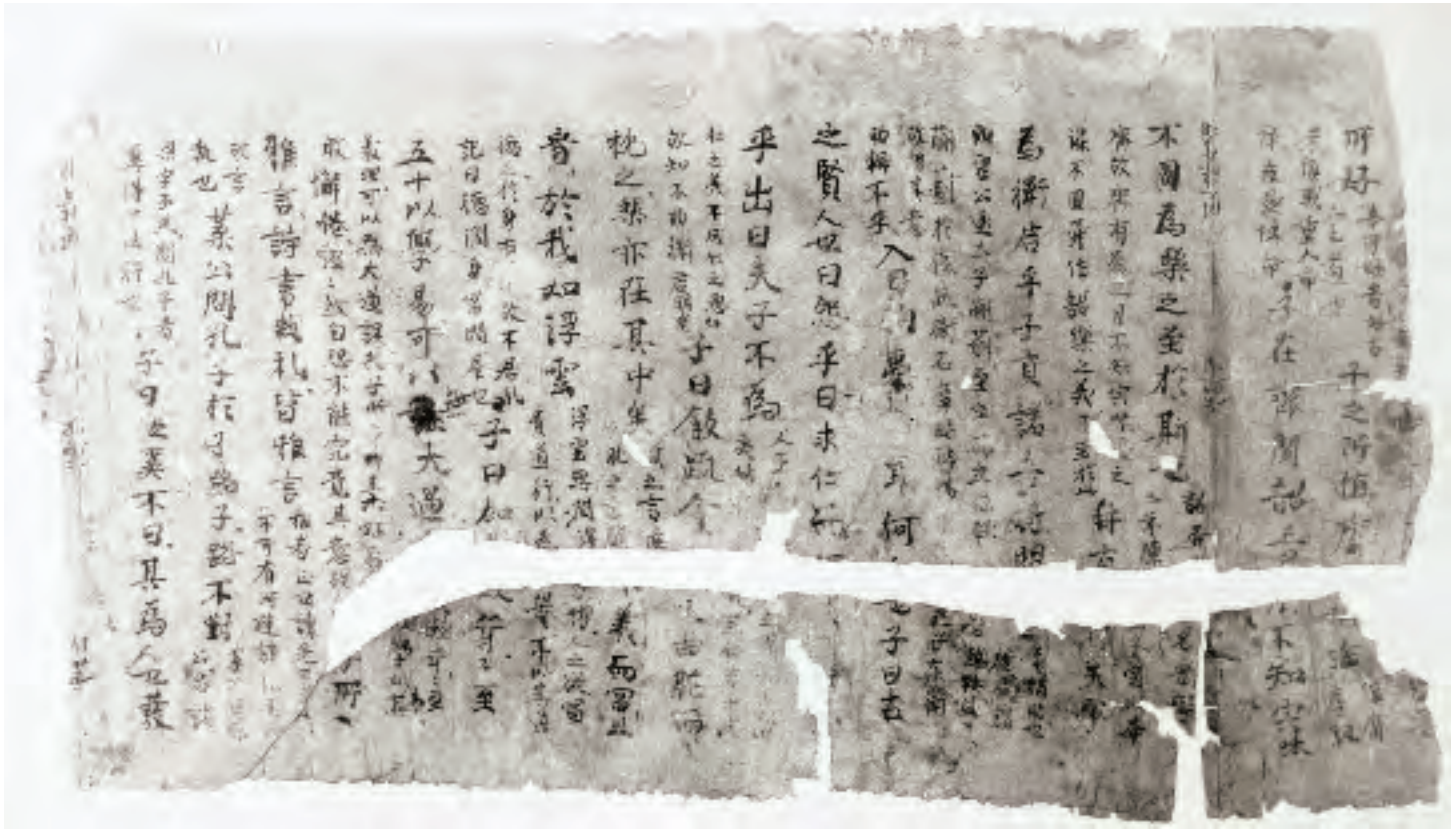
Today Confucianism remains one of the major spiritual traditions of the world—and Confucius' insights and nuggets of wisdom, handed down through *The Analects of Confucius*, a collection of his teachings, continue to hold relevance for people grappling with the ethical complexities of modern life. (For other major religious traditions in China, see The Three Teachings, page 20.)

Though Confucius' mother must have been overjoyed to give birth to the boy she had prayed for so ardently, it's hard to guess what she thought when she gazed down upon her newborn son in 551 B.C. in that cave in the state of Lu (today the Shandong Province). Historical accounts report that young Kong Fu Zi (Latinized by Jesuit missionaries in the 16th century as "Confucius") was an ugly baby with an exceptionally large head. Appearance-wise, things didn't get much better, according to historian Diane Morgan in *The Best Guide to Eastern Philosophy and Religion* (Renaissance Books). She writes that the adult Confucius was described as having a bulging forehead, lips like an ox and teeth like a rabbit.

Born out of wedlock to a poor but respectable family, Confucius came into the world during China's Spring-Autumn period (722-481 B.C.), a time when the kings of the Zhou Dynasty had lost nearly all their authority and were mere figureheads. Power instead rested within the hands of the aristocratic leaders of China's various provinces, who jockeyed for ever more influence and authority at the expense of their neighbors. As he grew to young adulthood, Confucius undoubtedly was affected by the disharmony of China's political milieu.

According to Zuo Zhuan, a commentary on the chronicles of Lu that included mention of Confucius' upbringing, the boy's father was an exceedingly strong man who once enabled his comrades to escape by single-handedly holding up a heavy iron portcullis, or gate. Already 70 years old at the time Confucius was born, he died three years later. Like other boys his age, Confucius spent his childhood learning the Six Arts: ceremonies, music, chariot driving, archery, writing and arithmetic. Not surprisingly, the young Confucius showed an early love of learning. He particularly venerated the early rites and music developed by the early Zhou kings during the so-called Golden Age of Antiquity at the beginning of the Zhou Dynasty (c.1027-256 B.C.).

Looking around him, at what he considered to be the moral decline of his



society, Confucius committed himself to reviving the peace and harmony of this earlier age. To do so, he studied (and would later be credited with editing) the Six Classics—Changes, Odes, History, Rites, Music, and Springs and Autumns. The book of Odes, in particular, was his constant companion, notes scholar John Chinnery in *The Sacred East* (Seastone).With its 305 songs, many of which had been sung at the Zhou court, the book of Odes was believed by Confucius to offer wisdom about how best to serve one's father and the king, and to provide an outlet for emotions.

As Confucius grew into adulthood and beyond, his studies of the Golden Age required great discipline. "I was not born with possession of knowledge, but being fond of antiquity, I ardently pursue it," he would later be quoted as saying in the *Analects*. And, "As we use a mirror to reflect the forms of things, so we study antiquity to understand the present."

Confucius married at age 19, and is known to have fathered at least two children, a son and a daughter. By age 30, he started teaching students, becoming the first sage of the day to take on students without regard to social class or money. As word spread, male students—eventually numbering in the thousands—flocked to learn at his side. Some records indicate that he cultivated 72 disciples, though only 25 have been identified in historical records by name. Describing himself as "tireless in learning and tireless in teaching," to the point that when inspired he would "forget to eat," Confucius was open to the insights of others. "When three people walk together," he said, "there is sure to be one from whom I can learn."

Confucius served for a time as justice minister of Lu, but reportedly resigned because he disagreed with the politics of his prince. Convinced that his theories could transform China's turmoil-filled political realm, he set out from Lu in 497 B.C. to travel the countryside. His goal: to gain a high government post and a bully pulpit from which to advance his ideas.

Accompanied by a few hand-picked students, he spent the next 12 to 14 years traveling through principalities in what is now northern China, passionately trying to convince political

Written after Confucius' death, over a period of 30 to 50 years, *The Analects of Confucius*, pictured above, is a work of 20 chapters that capture the heart of the great sage's teachings. A sampling of his wisdom:

- I am not bothered by the fact that I am unknown. I am bothered when I do not know others.
- He who is impatient over trifles will make mistakes in major enterprises.
- Rule by the power of moral example.
- To learn without thinking is fatal but to think without learning is just as bad.
- Is it not a pleasure to have friends come from afar?
- If you govern with the power of your virtue, you will be like the North Star. It just stays in its place while all the other stars position themselves around it.
- Juniors should be respected.
- If you do not give a thought to the distant future, you will be in trouble when it comes near.

leaders of the wisdom of his ways. His journey was a hard one, spent "living on coarse rice and simple vegetables," his only pillow his "bent arm," he would later report. At one point Confucius and his companions got lost in the wilderness and almost starved to death. At another, they were pursued by an armed band intent on killing them.

Ultimately, Confucius failed in his attempt to gain political office. He returned to Lu and set aside his political ambitions to focus on his teaching. Perhaps surprisingly for the time, Confucius encouraged his students to think for themselves. "There are people who act without knowing why," he once wrote. "But I am not one of them."

In his teachings, Confucius championed strong familial loyalty, and particularly emphasized the need to respect one's parents. Only by establishing harmonious relationships between father and son, husband and wife, elder and younger brother, friend and friend, and sovereign and subject (known as the "Five Relationships") he wrote, could an ideal government built on virtue (the Great Commonwealth or Utopia) be achieved. He urged his disciples to set aside their own selfish desires to pursue a righteous path, or *yi*: doing the right thing for the right reason. The outward sign of righteousness was *li*, or the practice of sacred rites. Rites such as ancestor worship and sacrificial ceremonies were integral to preserving the order of society and strengthening the Five Relationships, according to Confucius.

Politically speaking, he taught that the best government leads not through bribery or force but through genuinely good leaders who act by moral persuasion. His economic theory was premised on the idea of fair distribution. "Where there is harmony," he wrote, "there will be no complaint of shortage. Where there is contentment, there will be no rebellion."

As Confucius neared the end of his life, he seemed confident that the decades he had spent in the pursuit of wisdom had been well spent. "At fifteen, I set my heart on learning," he wrote. "At thirty, I became firm. At forty, I had no more doubts. At fifty, I understood Heaven's will. At sixty, my ears were attuned to this Will. At seventy, I could follow my heart's desires, and know they were right."

One night when he was 73 years old, the great thinker dreamed of his own death. These words came to him: "The great mountain crumbles. The strong man breaks. The sage withers away." Historical accounts show that he died a week later.

Confucius' teachings did not die with him, thanks to the efforts of his disciples; his only grandson, Zisi; and later influential thinkers Mencius and Xun Zi. At the time of death, however, the great sage wouldn't have known that he would be venerated for centuries to come. No matter to Confucius. "I am not bothered by the fact that I am unknown," he once said. "I am bothered when I do not know others."

"The Three Teachings"

In China today, Confucianism is one of "The Three Teachings" that many people practice simultaneously because they are so complementary. As the popular Chinese saying goes, "The Three Teachings merge into One." All are premised on the central idea that the cosmos is a sacred place and that all aspects of it are interrelated. The other two teachings are:

Daoism (or Taoism): Indigenous to China, this tradition (dating from the sixth century B.C.) focuses on harmony between humankind and nature. Dao (or "Way") represents the natural pattern underlying cosmic change and transformation. Practitioners strive to practice wu-wei (non-interference) with the Dao by growing in their attunement to natural forces. Humans are thought to reach full potential by being like rivers—flowing, receptive, powerful. Though there is some debate over his historical existence, philosopher Lao Tzu is recognized as the founder of Daoism. Today there are about 20 million practicing Daoists in the world.

Buddhism: Introduced from India in the first century, Buddhism took root and came to accommodate the Chinese perspective. Unlike other indigenous traditions, this one lays out the promise of universal salvation. Buddhism is centered on the teaching of the Buddha Sakyamuni, and holds that followers should strive for an understanding of the nature of reality (experiencing an "Awakening" or "Enlightenment") through years of spiritual cultivation. Across the world today there are about 350 million followers of Buddhism.

Integrity is a Personal Asset

By Michael Josephson

I saw a cartoon of an earnest-looking fellow standing in front of a man sitting behind a desk. The caption: "We admire your integrity, Daniel. Unfortunately, we have no room for that in our firm." This may not be an overstatement.

A 1995 survey of more than 2,000 secretaries in the United States and Canada revealed that nearly 60 percent had lied about their supervisors' whereabouts. OK, that's a moral misdemeanor, but nearly one in five also said they had falsely stated they witnessed a signature on a notarized document, and 10 percent said they had removed or destroyed damaging information from a file at the request of their bosses.

Usually, the lies and deceptions told at work aren't company policy. Instead, they reflect the flexible morality of individual supervisors who, out of ambition, fear or corrupt character, ask others to lie or look the other way.

Let there be no mistake: It's unethical to ask someone to lie to advance personal or business objectives. Executives should establish an environment where every employee is expected to be honest. And they must deal firmly and consistently with those who ask or allow employees to do otherwise. But it's also the responsibility of individual employees, regardless of their power or status, to exercise the moral courage to refuse to do anything unethical, even when ordered to do so. Your integrity is a personal asset. Don't let anyone mess with it.

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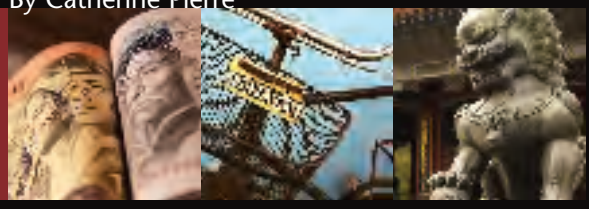
China

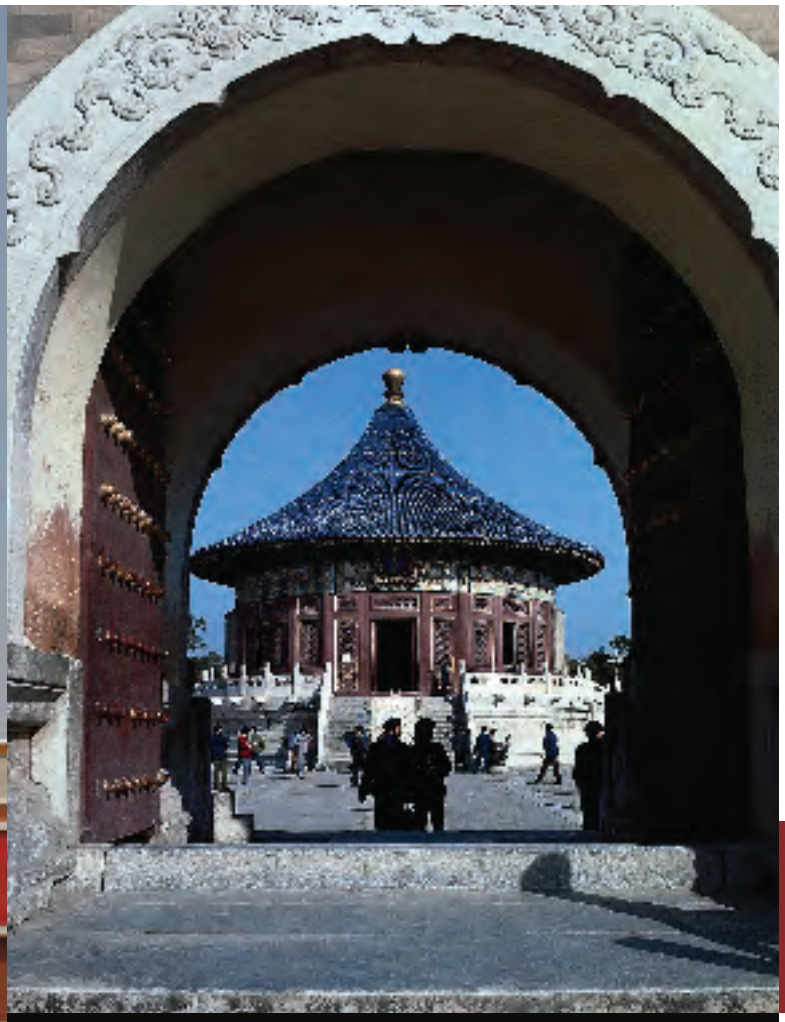
VAST, MYSTERIOUS AND RELATIVELY UNEXPLORED BY WESTERNERS, IT MAY BE THE TRIP OF A LIFETIME

By Catherine Pierre



China is a vast country—and vastly different from what Western travelers are used to. From the bustling capital city of Beijing to the remote mountains of Tibet, China offers an array of enchanting experiences unlike anywhere else in the world. Think of the Forbidden City, a royal palace that for centuries was off limits to all but the most elite; or the Great Wall, which spans 4,000 miles and has guarded China from invaders for thousands of years; or Shanghai—"Paris of the East"—a 19th-century port town once known for gambling and prostitution, now poised to become China's economic powerhouse.

For years, China—with all of its many treasures—was largely closed to the rest of the world. But recent capitalist-friendly reforms have opened the country to the West, making China one of the most-watched players on the world stage, and making this a great time to visit for anyone who wants to see what all the buzz is about. (According to the book *Lonely Planet*, China will likely be the world's leading travel destination by the year 2020.) With 1.3 billion people, China is the world's most populous country, and at about 3.7 million square miles, it is the world's fourth biggest. A country that size can be tough to navigate without some help, and you may want to consider going with a tour group. Charlotte Xu, executive director of China Advocates, has been planning tours of China for 20 years. She recommends visiting Beijing, Shanghai, Xi'an and, for a little break from all of that city life, Guilin.



Tiananmen Square, left, at the center of Beijing. The Temple of Heaven, above, was made in the 15th century entirely of wood, without a single nail.

Beijing

Beijing is China's political capital today, and has been for almost 1,000 years, through the Jin, Yuan, Ming and Qing dynasties. Here is where you'll find some of China's most important historical locations, the Forbidden City, for example, as well as sites you'll recognize from more recent events—Tiananmen Square is located here. It is also home to one of the world's most exuberant building booms; hardly anyone touring Beijing can fail to notice the number of construction cranes that fill the skyline. The city is preparing for the 2008 Summer Olympics, which only adds to its big, bustling, crowded character.

China was closed to the Western world for much of the last few decades, and many Chinese now see the upcoming Games as a chance to show off their city and their culture to the rest of the world. Beijing holds a great many treasures, and Xu recommends that you plan to spend a few days at least exploring this vast city.

Home to the Ming (1368-1644) and Qing (1644-1911) dynasties, the Forbidden City was so called because commoners were not allowed in; however, the 24 emperors who lived there—along with their many wives, concubines and children—rarely left the cluster of buildings that make up the Forbidden City, meeting with their ministers to conduct government business within its walls. Now referred to as the Palace Museum, the city took 14 years to build, from 1406 to 1420, and the labor of thousands of men. It is rumored to have 9,999.5 rooms (though a modern survey puts the number at around 8,600) and covers 720,000 square meters, or about 7,750,000 square feet (about 178 football fields).

Visitors to the Forbidden City can tour the Outer Court, which was used for ceremonial purposes such as coronations

and imperial addresses; and the Inner Court, where the emperors and their families lived. The Palace Museum also holds one of the most important collections of imperial art, including paintings, bronzes, textiles, timepieces, sculpture and jewelry. Listed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a World Cultural Heritage Site in 1987, the Forbidden City hosts 6 million to 8 million visitors each year and sits literally at the center of the city. "You can just imagine the biggest palace in the world sitting in the middle of Beijing," says Xu. "The palace is the center, the pillar. Everything is built around it."

The Temple of Heaven is another of Beijing's most famous historical sites, and is considered one of the Ming Dynasty's most important architectural accomplishments as it is made entirely of wood, without a single nail. Construction began in the early 15th century, and the temple was used for ceremonial purposes, when the "son of Heaven"—the emperor—would come to pray.

Beijing is also a good starting place to visit the Great Wall, a structure that extends about 4,000 miles. Originally the wall was several walls, built by individual states during the pre-dynastic period as defense. The "First Emperor"

China is the world's oldest continuous civilization, with records dating back more than three thousand years. For much of its history, China was ruled by a succession of dynasties. Artifacts from the Shang Dynasty date from 1500 B.C., though Qinshihuangdi is considered "the First Emperor" because he unified all of China under his rule. Dynastic rule continued until the 17th century.

1644: The Manchus overthrow the Ming Dynasty and establish the Qing Dynasty, China's last.

1840: The first Opium War begins.

1842: China cedes Hong Kong to Great Britain as part of the Treaty of Nanjing.

1911: A military revolution forces the last Qing monarch to abdicate, establishing a new republic.

1920s: Sun Yat-sen, whose ideas had inspired the uprising, founds the Kuomintang (KMT), or the Chinese Nationalist People's Party, to unite a warring China.

1925: After Sun's death, Chiang Kai-shek takes control of the KMT and opposes the Chinese Communist Party (CCP).

1934: Defeated by the KMT, the CCP begins the "Long March" to Shaanxi, where it establishes its base. Mao Zedong takes control of the party. The two parties will struggle for years, and by 1949, the CCP will control most of China.

Qinshihuangdi—so called because he united China under one rule, in 214 B.C.—ordered that the Wall be connected to become one massive structure protecting the northern border. During the Han period (206BC - 220AD), the wall was extended westward (a section of that wall was recently discovered in the Xinjiang region), and much of the Great Wall we see today was built during the Ming period. Time has taken its toll on the Wall, and both natural and man-made forces have left much of it in ruins. But many sections have been restored to become one of the most popular sites for visitors to China. Organized tours are available, or you can visit particular sections on your own. An easy drive from Beijing, Badaling is one of the best restored sections of the wall, but it is also one of the most popular, so expect crowds, as well as many souvenir shops. Mutianyu is a little farther away—about a two-hour drive—and offers fewer crowds, beautiful scenery and a cable car to get you to the top. Finally, Jinshanling, about three hours away, offers stunning views, few crowds and a great starting point for a day-hike along the wall.

Shanghai

If Beijing is China's Washington, then Shanghai is its New York, or its Las Vegas, or its Paris—all glitz and glamour and excitement. The city's port has made it an economic center since the Opium Wars of the mid-19th century, but Shanghai has recently been undergoing a massive rebirth. As multi-national corporations set up shop in the city, the economic boom is turning Shanghai into a leading destination for shopping, eating and entertainment.

Plan to spend part of the day exploring the Bund, Shanghai's famous waterfront boulevard running along the west bank of the Huangpu River, where old colonial buildings mingle with gleaming new architecture. The Bund is particularly beautiful at night, so to get the best view, take a

Know Before You Go

Today in China, 90 percent of the population is Han Chinese, with the rest comprised of a handful of ethnic minorities. Though there are several major dialects, most Chinese speak Mandarin, which is taught in the schools and used by the government. The country is officially atheist, but the constitution recognizes religious tolerance (though the government's recent newsworthy crackdowns on followers of the Falon Gong religion suggest otherwise).

If you're traveling to China, you'll need a valid passport and a visa, and you'll want to check with the Chinese Embassy (www.china-embassy.org/eng/) for any current travel restrictions. The country is extremely cold in the winter and extremely hot in the summer (which tends to be the height of the tourist season) so consider a spring or autumn trip.

The Great Wall of China, left, was originally built as several walls and is more than 4,000 miles long. The ultra-modern skyline of Shanghai, right.

1949: Mao establishes the People's Republic of China, based on the Soviet model.

1958: Mao announces the "Great Leap Forward," an economic program aimed at increasing industrial and agricultural production that would ultimately be ruinous.

1966: Mao launches the "Great Proletarian Cultural Revolution" to rally popular opposition against his political foes within the communist party.

1976: Mao dies.

1980: After the Third Plenum a few years earlier, the government adopts more pragmatic policies and officially declares the Cultural Revolution a catastrophe.

1989: Responding to rampant inflation and economic hardship, students and intellectuals gather in Tiananmen Square to demand political reform. Though the protest is peaceful, the government declares martial law, and hundreds of protesters are killed.

1992: Guided by Deng Xiaoping, the government officially adopts a more market-oriented economy, with the goal of raising the standard of living in China. In the years following, China has seen more economic reform and has increasingly opened to the Western world.

1997: Sovereignty of Hong Kong is transferred back to the People's Republic of China.

Source: U.S. Department of State, www.state.gov/r/pa/ei/bgn/18902.htm

Mind Your Manners in China

"Chinese culture is very old," says Charlotte Xu, executive director of China Advocates. "People treat each other with great respect and courtesy. Families and relationships are everything in our social dynamics."

To that end, if you're traveling in China, there are a few things to keep in mind. Perhaps topping the list is the idea of "face"—which basically means that you should never embarrass someone or challenge their status in front of others. It's probably a good idea not to challenge someone's authority, bring up awkward personal facts or get angry in public.

Gift giving is another major factor in Chinese culture. Xu recommends travelers bring small souvenirs from home. If you're invited to someone's house, she says, you'll be well treated, so return the favor by presenting your hosts with a gift. Similarly, if someone at your hotel (or anywhere for that matter) does you a favor, a gift is in order as a gesture of thanks.

And keep in mind that Chinese people tend to be less outwardly emotional than Westerners, especially when meeting strangers. So a nod of the head or a quick handshake is in order, as are a few personal questions—about family, marital status, etc.—to establish some common ground.

Generally speaking, if you're courteous to the Chinese, you'll be rewarded in kind.

Thousands of life-sized terra-cotta soldiers and horses, below, were buried in Xi'an to protect China's "First Emperor" in the afterlife.

ferry across the river to Pudong, Shanghai's new financial district on the east side of the river. Xu recommends dinner at the Grand Hyatt, where Cloud 9, a lounge located on the 87th floor, offers a 360-degree view of the city. While in Shanghai, you may also want to catch a show at the Shanghai Grand Theatre, which holds performances nightly and features a combination of Western and more traditional Chinese programming. A special highlight is Chinese acrobatics, a 2,000-year-old folk art form that includes lion dances; cycling tricks; juggling items such as chairs, plates or giant jars; and wushu, or traditional group gymnastics.

If you get the chance, take the trip from Pudong Airport to Shanghai on the Maglev train. The first-ever train built using the German technology, the Maglev transports passengers the 19 miles (30 kilometers) from the airport in just over seven minutes.

Xi'an

Any trip to China should include a stop in Xi'an, the ancient capital and burial site of the "First Emperor," Qinshihuangdi. It is also home to Qinshihuangdi's famed Army of Terracotta Warriors. In the early 1970s, a peasant stumbled across a terra-cotta relic while digging a well. His find would eventually lead to the excavation of thousands of life-sized terra-cotta soldiers and horses buried to protect Qinshihuangdi in the afterlife.

Several years ago, a handful of the soldiers toured museums in the United States to much acclaim. But nothing can compare to seeing the rows and rows of soldiers, who have stood in that exact place for thousands of years, in person. A museum has been built over the excavation site, and the peasant, now in his 80s and something of a local hero, is often available at the museum to sign autographs.

While in Xi'an, visit the Big Goose Pagoda, built in the seventh century by the Tang emperor Gaozong to hold Buddhist scriptures brought from India by Xuan Zang, one of China's most important monks; the Grand Mosque, built in the 18th century and an important site for the country's estimated 20 million Muslims; and the Forest of Steles Museum, which was once the temple of Confucius and now holds thousands of carved stone tablets, the earliest dating back to the Han Dynasty.

Outside of the Cities

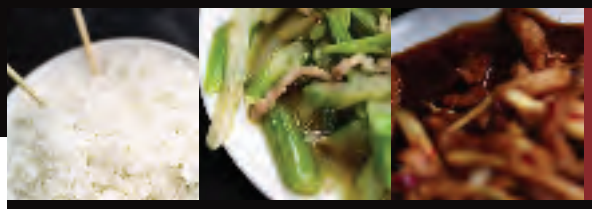
If you want to get out of the city and experience some of China's more natural beauty, head to the city of Guilin, in southwest China. Guilin is located on the Li River, bordered on both sides by magnificent limestone formations. Take a tour down the Li, and at the end, enjoy some hiking or biking through the countryside. "This is one of the most idyllic, poetic places in China," says Xu. "It's like a Chinese landscape painting, with white farmhouses and green rice pad-

The Yangtze River, above, is the third longest in the world at 3964 miles (6380 kilometers).

dies and beautiful hills in the background—it's paradise."

Tours of the Yangtze River are another popular option. The Yangtze is the longest river in China—the third longest in the world—originating in Tibet and flowing through seven provinces on its way to the East China Sea. Tours originate in Chongqing and can take from four to as many as 12 days. The highlight of the river is unquestionably the trip through the stunning peaks and cliffs of the Three Gorges—though with the completion of the Three Gorges Dam in 2009, the rising waters may diminish the experience.

Finally, for a tour of the cities and countryside, take a trip along the Silk Road, the ancient trade route linking China to the West. Though the Silk Road got its name in the 19th century from a German geographer named Ferdinand von Richthofen, it has been traveled for more than 2,000 years, and it was used for the trade of everything from food and textiles to luxury goods to horses. Beginning in Xi'an, the route travels west to Dunhuang, where a collection of temples known as the Mogao Grottoes house an important collection of Buddhist art. Just south of Dunhuang, the Gobi Desert's dunes are interrupted by an oasis pool called Crescent Spring. A park there offers tourists the chance to try camel rides and dune surfing. After Dunhuang, the Silk Road splits into three routes. Most visitors travel the northern route and make their way along the Taklamakan Desert to Kashgar, where they can still get a feel for the old Silk Road trade at the local bazaar.



What to Eat

Chances are, you're fairly familiar with Chinese cuisine. But your dining experience in China promises to be different from the cardboard carryout boxes you're used to.

For one, rather than serving as merely a vehicle for your main dish, grains—in the form of rice, noodles or steamed buns—are an integral part of a Chinese meal, meant to balance the vegetables, fish and meat. For another, if you're having soup, it will be served last. And the fortune cookie? Forget it. Not only are the Chinese not big on desserts, but that ubiquitous, message-bearing after-dinner treat wasn't invented in China and is rarely eaten there.

Breakfast—unless you're specifically offered a "European-style" morning meal—will generally consist of many of the same foods you've eaten for dinner the night before: rice (in the form of porridge), plain or filled steamed buns, pickled cucumbers and deep-fried dough. Midday, expect to have rice or noodles served with some vegetables and meat. Dinner tends to be a larger affair, with food served family-style: Each diner has his or her own plate of rice, but will use chopsticks to share a variety of meat and vegetable dishes—often right from the serving dish.

Respect in the Workplace—It's for More Than Just People

Respect. Whether it's from our boss, our employees, friends, families or neighbors, we need to feel respected. We understand that need to feel respected, but we do not respect all of the devices we use every day to make our jobs easier. Power tools are respected. Equipment is respected. Industrial hose? Heck, what can only 100 psi do?

There are two major categories of hoses: Hydraulic and Industrial. Hydraulic hoses command a tremendous amount of respect in the workplace mainly due to the huge pounds per square inch (psi) rating they carry. The thought process is: "3,000 psi! If that thing comes undone somebody's going to get killed!" Industrial hose is the Rodney Dangerfield of the hose world. Most people using industrial hose show little, if any, respect for this type of hose. They throw it, walk on it, kick it, run over it and sit on it. Most people do not realize the amount of energy inside that industrial hose they have been using and abusing.

There are two dynamics at work in every hose. First, there is psi. Pasquale's law says there must be equal pressure in all directions. The hose is a pressure vessel that is designed to contain a certain amount of outward pressure. The second dynamic at work is force. Force is the linear energy that runs the length of the hose. In essence, it's what is trying to push the fitting out of the end of the hose. Force is calculated by taking the area of a cylinder (hose I.D.) in square inches multiplied by the pounds per square inch. This gives you force in pounds. If you have ever seen a video of a firefighter being tossed about by a fire hose, this is force in action.

For example: a 2-inch I.D. hose at 100 psi has 314 pounds of force. An 8-inch I.D. hose at 100 psi has 5,027 pounds of force. Hanging a full-size pickup truck from the end of that 8-inch hose would have the same force. The couplings at the end of the hose are trying to deal with the stress from the weight of that pickup truck. This is why the couplings and clamping devices that worked well with that 2-inch hose probably won't work for that 8-inch hose even though the pressure (100 psi) is the same.

Let's compare two typical applications: 1/2-inch I.D. hydraulic hose at 3,000 psi and 4-inch I.D. industrial hose at 150 psi. The 1/2-inch hydraulic hose has 588 pounds of force. The 4-inch industrial hose has 1,885 pounds of force. The industrial hose has more than three times the force of the hydraulic hose, but the hydraulic hose is the one everyone is afraid of. In other words, if both hoses were to whip, the industrial hose would pack more than three times the punch of the hydraulic hose.

Many people are injured and some are killed every year because they do not understand the power of the industrial hoses they use every day. Industrial hoses need to be used properly, inspected regularly and stored correctly.

Everyone wants a safe workplace. One way of improving safety is to understand the dynamics in the workplace and that includes the dynamic of force. Before you kick that industrial hose out of your way, remember that it can kick back with deadly force.

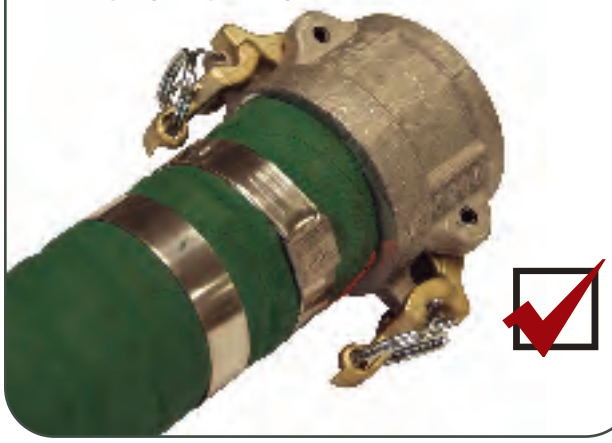
DOs AND DON'Ts - CAM AND GROOVE FITTINGS

DO:

• Visually inspect cam and groove fittings before using.

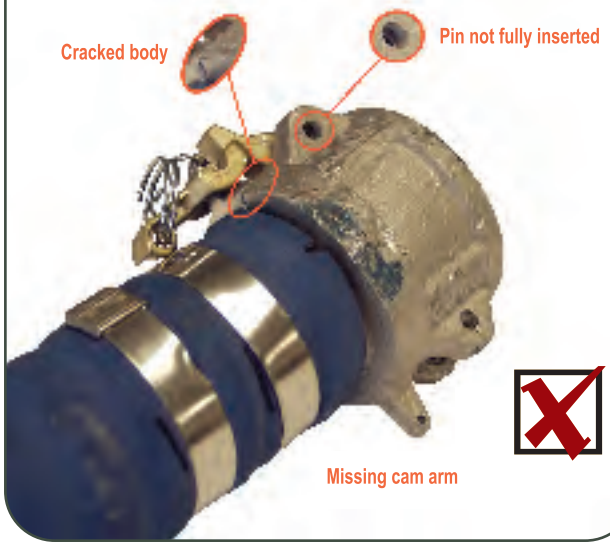
Check for:

- missing or damaged cam arms, rings and pins
- coupling movement or incomplete insertion into hose
- missing or damaged gaskets
- coupling body damage



DON'T:

• Use damaged or incomplete couplings for any purpose.



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Staying Fit in Mind and Body

Traditional Chinese Martial Arts: Wushu

By Sue De Pasquale

Eric Chen was 19 when he first witnessed the Chinese martial art of wushu. The year was 1974 and the national team of China had come to perform in the United States as part of President Nixon's attempt at "Ping-Pong Diplomacy"—using sports as a bridge between the two countries. Chen was mesmerized. The beauty and athleticism of the martial art, often known in the West as "Kung Fu," was like nothing the Californian had ever seen.

"Wushu is considered China's national sport. It has been passed down for over 3,500 years, through wars and upheavals," says Chen. "I realized that the only way to learn this art would be to go to China."

Chen made his first trip in 1981 to begin training in wushu and has returned every year since. Today he is considered one of the United States' leading experts in the sport. He has trained most of the American medalists at the World Wushu Championships and he is director of the National Wushu Training Center in California, where students of all levels and ages take classes. Many martial arts stars of the silver screen (including Ray Park and Michael Jai White) have also trained there.

Originally conceived as a means of military training, wushu today "still adheres to its mission of beauty, quality and difficulty to truly bring forth the best human spirit and physical capacity," says Chen. It can be practiced solo, paired or as a group—barehanded or armed with ancient Chinese weapons.

Practitioners of wushu see immediate gains in health and fitness, according to Chen, and once they start training, they often can't get enough. "You acquire a lot of strength and flexibility, and you are mentally and spiritually challenged," says Chen. "It's not repetitive like running or swimming. Wushu makes you want to practice because you are constantly being challenged to perfect a more difficult or more beautiful

What is Wushu?

In an effort to revive the glory of China's great martial arts tradition, the communist government created wushu (literally "military art" or "art of war") after 1949, as both an exhibition and a full-contact sport. Wushu is a more precise term than the widely used "kung fu," which can mean either martial art or "skill."

It is now China's national sport, advanced by working committees at the national, provincial and district levels, and has spread across the globe, thanks to the efforts of the International Wushu Foundation. At the 2008 Beijing Summer Olympic Games, China will organize a Wushu Tournament.

Many well-known martial artists of movie fame are or were wushu practitioners, including Jet Li (five-time national Wushu champion of China), Bruce Lee, Jackie Chan, Jacky Wu and Ray Park.

move." What's more, he says, "It's a very complete form of exercise. There is no area that you neglect."

Chen recommends taking three 90-minute classes each week. Students who follow this course can advance from beginner to master level in four to five years. Here's how a typical 90-minute wushu class at Chen's training center breaks down:

Cardiovascular exercises (5 minutes)

Goal is "to warm up the blood." Chen likes to make it fun, with a game of "tag" or "chase."

Stretching (10 minutes)

Students work through stretches of every joint and muscle group, pushing each time to gain more flexibility than the session before. Within about six months some beginners are able to do forward and straddle splits, and to bend backward into a "bridge" position, with feet and hands on the floor and stomach facing the ceiling.

Basics (30 minutes)

Instructors devote about 10 minutes to teaching each of the wushu basics: various techniques for hands (open and closed), stances and kicking.

Forms (30 minutes)

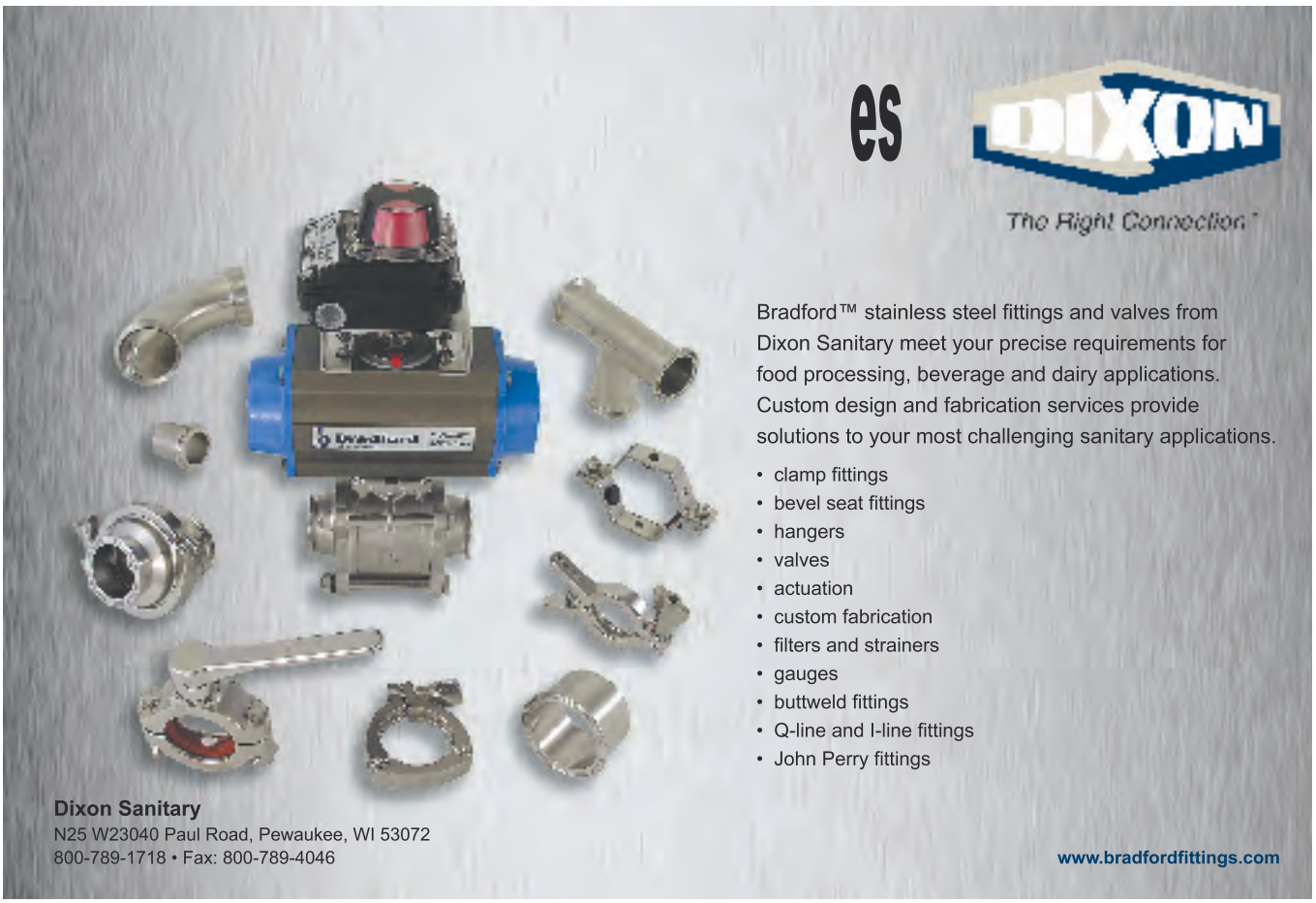
Similar to the floor exercises that gymnasts do, "forms" are choreographed series of techniques or movements, performed alone or as "fighting" sets between two sparring partners. In wushu, the focus is less on combat (how hard you can kick an opponent), however, than on fitness and athleticism (how high you can kick; how beautifully you can perform a move), says Chen, noting that this differentiates wushu from many other martial arts. Forms build strength and flexibility, speed and stamina; teach balance and coordination; and help students remember the many techniques they learn.

Some forms are done with "empty hands," while others are performed with weapons. Beginners start by using a simple staff or stick, then advance to sabers, steel whips and other more exotic weapons.

Physical Conditioning (15 minutes)

Wushu's high jumps, kicks and flips require rock-hard abdominal and leg muscles. Chen puts his students through a series of calisthenics, including 40 to 60 reps of "V" sit-ups, and a "Superman"-style exercise that strengthens the lower back; exercises aimed at strengthening the knees, ankles and toes to protect against landing shock; and short, powerful sprints that help build explosive speed and jumping ability.

Many of the students who have trained at the National Wushu Training Center have traveled with Chen to China to train in Beijing and to compete. The benefits of such travel are far-reaching, he says. "Wushu is a very culturally fulfilling sport. Westerners who take it up learn that they like the Chinese language, the food, the calligraphy, the music. You can make a lot of friends."



The Telephone

Talking to your neighbor hasn't always been as easy as picking up the receiver

By Catherine v.O. Hoffberger

"Mr. Watson, come in here. I need you!"

These historic words are as recognizable as Martin Luther King Jr.'s inspiring "I Have a Dream" and John F. Kennedy's philosophical "Ask not what your country can do for you—ask what you can do for your country."

Uttered by one Alexander Graham Bell on March 7, 1876, this quote is remembered not for its eloquence or effect, but for what it represents: the invention of that great tool of everyday life, the Telephone.

Bell, born in Scotland to a deaf mother in 1847, followed the professional footsteps of his father, uncle and grandfather, all professors of elocution (the study of speaking). Young "Aleck," a passionate elocutionist, specialized in teaching speech to the deaf.

Telephony, the science of producing sound ('phono') electrically over distance ('tele'), was the rage among 19th-century inventors. The telegraph, created in England in 1833 and soon improved by American Samuel Morse, accomplished that in staccato, on-and-off rhythms. By the mid-1800s, it was the world's means of long-distance audible communication. Bell and other scientists across Europe and in the United States including Antonio Meucci, Johann Philipp Reis, Elisha Gray and Thomas Edison, experimented with ways of increasing the telegraph's capabilities.

1873 found Bell teaching at Boston University, and pursuing a new passion: acoustics. In his home laboratory, he worked to develop a tool for sending music, or voices, over distance. Such a device required a system of producing tones in constant "undulating," or waving, current.

His experiments caught the attention of Boston lawyer Gardiner Hubbard, the father of deaf student Mabel Hubbard (who would later become Bell's wife). He and a colleague financed Bell's research, thereby forming the partnership that would later be known as the Bell Telephone Co.

In three years' time, Bell's labors bore fruit. On February 14, 1876, he applied for a U.S. patent for his contraption. Composed of many complicated parts, it was essentially what we see in modern telephones: speaker, transmitter and receiver.

Three weeks later, Mr. Watson famously heard Bell summoning him over its wires. As his was the first telephone to truly work and receive a patent, Bell was credited with the invention.

Bell's fledgling business sold just six telephones in its first month. But by 1891, the company, by then known as AT&T (the Atlantic Telephone and Telegraph Co.), was operating some 5 million phones in America. Today, AT&T and other firms are responsible for hundreds of millions of phones worldwide.

Since its earliest days, the telephone has benefited from continuous research and improvements. Evolving technologies, from electric to fiber optic to cellular, have produced the evolution from the heavy, black crank-up phones of yesteryear to dial, push-button and cordless, to the Internet and today's omnipresent cell phones.

Bell anticipated that his invention would change the nature of communication, but surely he would be amazed by the telephone's vital role in daily life these 130 years hence.

Could he have predicted that the people of the 21st century would be in constant contact with each other, made possible by the personal phones we carry in our pockets?

If so, perhaps he would have changed the words that would become his most famous. He may have asked: "Mr. Watson, can you hear me now?"

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