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CONNECTING TO INDUSTRY

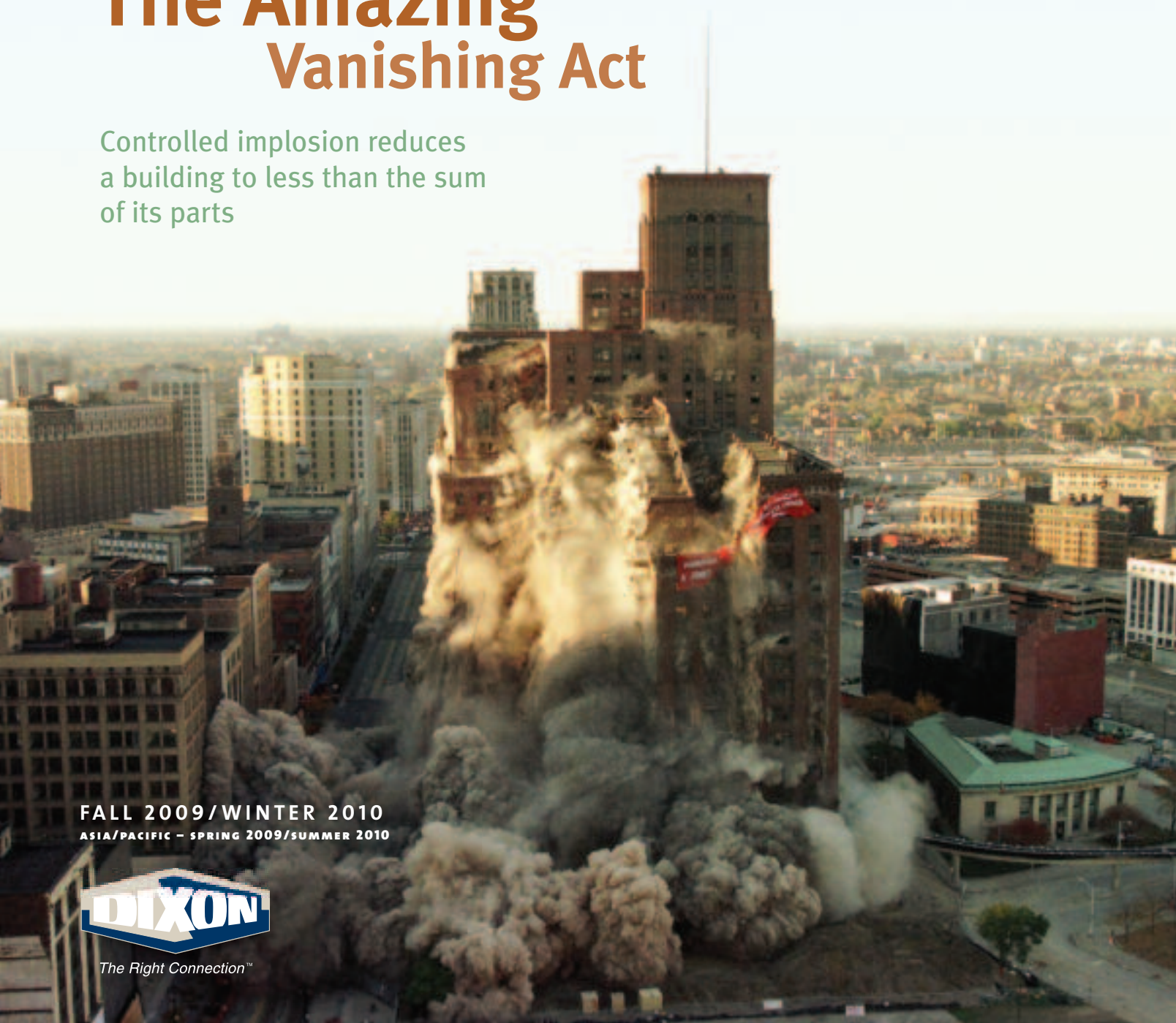
The Amazing Vanishing Act

Controlled implosion reduces
a building to less than the sum
of its parts

FALL 2009 / WINTER 2010
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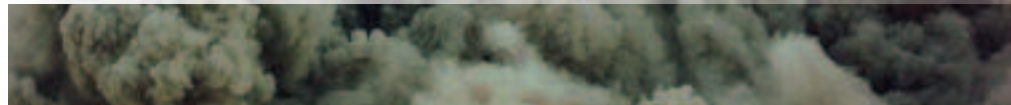
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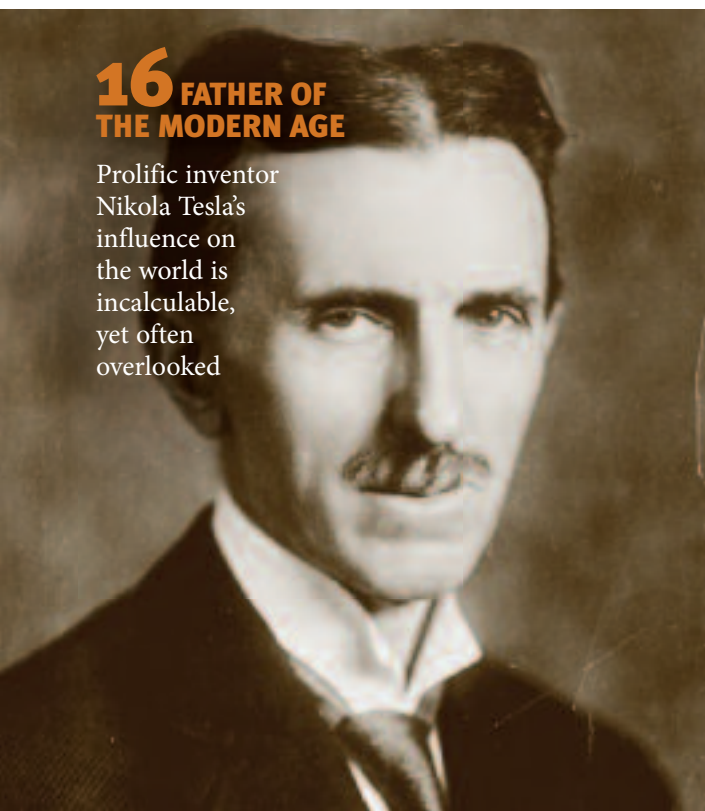
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Controlled implosion manipulates the laws of physics to reduce a building to less than the sum of its parts



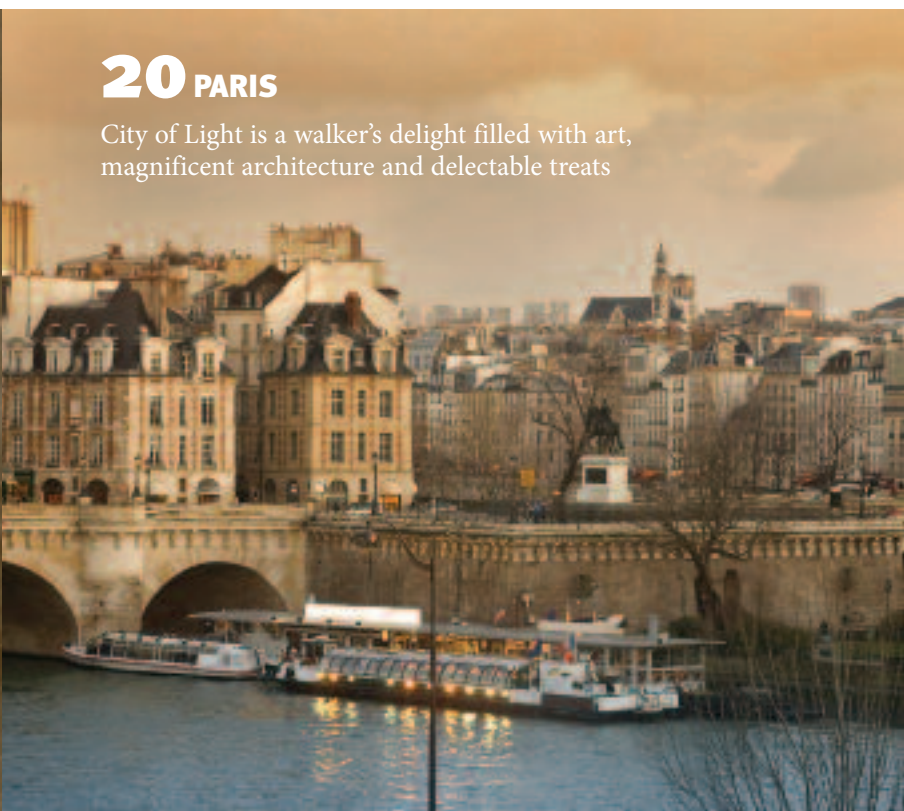
16 FATHER OF THE MODERN AGE

Prolific inventor Nikola Tesla's influence on the world is incalculable, yet often overlooked



20 PARIS

City of Light is a walker's delight filled with art, magnificent architecture and delectable treats



In my opinion ...



IF HISTORY REPEATS as it has a tendency to do, the difficult economic times we find ourselves in will pass. The question is, however, will our companies and the business environment that they operate in be the same coming out of this challenge as they were going in? We should be concerned that some of our government's efforts to minimize the effect of this downturn will dictate a new reality of bigger and bigger government.

In the past, capitalism and the free-market system righted the ship when it needed it and promoted growth. In this case, government intervention seems to have gotten in the way of an orderly recovery by selectively deciding who should receive assistance and who shouldn't. The problem is that when government interferes the delicate equilibrium of the market force is disrupted. This causes the small and medium sized businesses that create most of the jobs to be overlooked, except when it comes to increased regulation and taxes, to pay for the bailout of the select few.

Dixon has been in business since 1916 and has weathered the inevitable ups and downs by following solid business fundamentals and listening to our customers. It is of concern that many companies now receiving government support have not followed these sound principles, and yet have been permitted to survive not based on the results of their balance sheets but on other questionable criteria. No longer can we sit on the sidelines while government bureaucrats dismantle a system that has proven to be so successful. We believe that government needs to support free enterprise and allow the capitalist market to operate. Consider contacting your representatives and let them know how you feel!

Thanks for reading.

Dick Goodall

BOSS

FALL 2009/WINTER 2010

ASIA/PACIFIC – SPRING 2009/SUMMER 2010

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A Tribute to Lincoln

BY MICHAEL JOSEPHSON

OK, I'm an Abraham Lincoln groupie. He is by every measure my biggest hero. My daughter Abrielle was named after him and our dog is named Lincoln. By sheer good fortune, my son Justin was born on Lincoln's birthday. I often visit the Lincoln Memorial and stand in awe of his magnificent eloquence and his legacy of honor, courage, compassion, humility and humor.

Yet in his own time he was more often ridiculed than revered. He was unmercifully belittled in the papers that often called him unrefined, simple, a bumpkin. He was ungainly, to some downright ugly.

But what a man! Self-educated, self-made, he was a skillful lawyer and effective politician whose character made his name almost synonymous with integrity. He was an inspirational leader who really believed in democracy—a government of the people, by the people, for the people. Empathy and compassion were in his blood. He felt the pain of others as deeply as any man could, yet duty made him a leader of our nation's bloodiest war.

Now one of the most esteemed men in all history, Lincoln was often depressed by feelings of inadequacy. Groucho Marx once joked, "I wouldn't want to be in

any club that would have me." But the original source for this classic line was none other than a young, self-effacing Abraham Lincoln, who quite seriously wrote to a woman who rejected his marriage proposal: "I can never be satisfied with anyone who would be block-head enough to have me." It's interesting, in a world that places such a high value on self-esteem, that one of America's truest and greatest heroes was genuinely, perhaps excessively, humble. ■

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PROFILE OF COURAGE

PHOTOS COURTESY COFFEE ENTERPRISES, INC.



Capt. Gerald Coffee joined the Navy in 1957 and spent a total of 25 years in the service.

A Life with Purpose

Determination and focus helped Capt. Gerald Coffee survive seven years as a prisoner of war

BY SARAH ACHENBACH

“Eject! Eject!” Capt. Gerald Coffee screamed to Lt. Robert T. Hanson, the navigator of the RA-5C Vigilante aircraft. The Navy plane, piloted by Coffee, had just been hit by enemy fire during a Feb. 3, 1966, reconnaissance mission off the *USS Kitty Hawk*. Coffee and Hanson had been gathering intelligence against a heavily defended area of North Vietnam.

Not hearing a response from Hanson, Coffee immediately pulled the face curtain on his own ejection seat. Both men were automatically released from the aircraft, which was still speeding across the sky at 680 miles per hour.

The crewmen managed to send a signal on an emergency survival radio beeper before ejecting safely from their burning plane. The aircraft then exploded

and plummeted into the Gulf of Tonkin off the coast of the North Vietnamese Nghe An Province. As Coffee and Hanson's parachutes hit the water, enemy boats raced to pick them up. Coffee was captured immediately, and though he reported seeing Hanson nearby when they landed in the water, Coffee never saw him again. (In November 1988, Vietnam returned Hanson's remains to the U.S. government.)

Though only 32, Coffee, who joined the Navy in 1957 after graduating from UCLA with a degree in commercial art, had seen his share of danger. He was one of the first reconnaissance pilots to fly low-level missions over Cuba during the Bay of Pigs Crisis in October 1962. The photos from his mission proved

to the United Nations that Cuba was stockpiling Soviet nuclear missiles, and he was awarded the Distinguished Flying Cross. For the next three years, Coffee was a flight and reconnaissance training instructor assigned to Heavy Reconnaissance Attack Squadron Three in Sanford, Fla., before being deployed to Vietnam in 1966.

For seven years and nine days after he was plucked from the water by his captors, Coffee was held as a prisoner of war and was tortured by the North Vietnamese. Much of his time was spent in solitary confinement. Coffee's first prison cell—a dank, squalid cubicle 6 ½ feet long and barely wider than his body—had a tiny, double-barred window with a view of the prison wall. When he moved, the heavy wooden shackles around his ankles knocked into the small, lidless bucket that served as his bathroom. The tiny space did not prevent him from moving. To pass the hours, Coffee

“walked” several miles each day by taking three steps around the perimeter of his cell, turning with each step.

Any communication with another prisoner meant severe punishment. Using a tap code system based on 25 letters except “K” arranged in five rows of five, Coffee and his fellow POWs—many of whom he would never meet face-to-face—tapped out covert conversations on cell walls. Though there was no formal teaching of the tap code, most new “residents” of POW camps caught on within a matter of days. Through tapping, they comforted and encouraged one another.

“We encouraged and cared for each other. We passed information, learned poetry, even learned languages,” says Coffee. They also relied on humor to bolster spirits. “My first shower was in a dank, converted cell with water dripping down from a rusty pipe,” says Coffee. “Totally dejected, I looked up to let the water splash on my face and saw

scratched on the wall the words: ‘Smile. You’re on Candid Camera.’”

In 1970, the North Vietnamese transferred Coffee to the “Hanoi Hilton,” the infamous Hao Lo prison in downtown Hanoi. There he met fellow POW John McCain, who would later become a U.S. senator and run for president in 2008. Over tapped conversations late into the night, the two men became close friends and were released together on Feb. 12, 1973.

Upon release, Coffee was decorated with the Silver Star, two Bronze Stars, two Purple Hearts, the Vietnam Service Medal with 13 stars and other awards. He served an additional nine years in the Navy before retiring with a total of 25 years of military service. His sense of duty also extended to the political arena. Coffee made two unsuccessful bids for office: first for state office in 2004 and for a U.S. Senate seat in 2006; and he worked for his fellow POW as head of the John McCain 2008 presidential campaign in Hawaii.

Coffee earned a master’s degree in political science from Cal-Berkeley after his release, and the California native, who now lives in Hawaii (a dream he held while in captivity), has forged a new career as a motivational speaker. To survive in captivity, Coffee learned to rely on both a personal creed he developed—faith in yourself, in others, in America and in God—and the POW’s guiding principles of “Return with Honor” and “Unity Over Self.”

Through his speeches and in his autobiography, *Beyond Survival: Building on the Hard Times—A POW’s Inspiring Story* (Coffee Enterprises, 1990), Coffee, now 75, speaks of his POW experience as a metaphor for human survival: “I quit asking God ‘Why me?’ ... and asked him to help me to use this time productively so [the time] is not ... a vacuum in my life,” he says. “After that realization ... every day took on a new meaning because there was purpose.”

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The Amazing Vanishing Act

Controlled implosion manipulates the laws of physics to reduce a building to less than the sum of its parts

BY SALLY ADEE



Two buildings were about to vanish in a cloud of smoke and thousands of onlookers choked the Las Vegas Strip. Neighboring casinos' parking garages were jammed with spectators brandishing cameras. The parking lot of the New Frontier casino, across the Strip, was home to the official demolition party. Hundreds of well-heeled spectators mingled with lawn chairs and coolers, making the place look like an upscale tailgate party. It was March 13, 2007, and both towers of the Stardust Resort & Casino were coming down.

The skeletal shell towering in front of the crowd bore little resemblance to the majestic and mythical structure that had once dominated Las Vegas' cityscape. For 50 years, the 188-foot Stardust sign had been shorthand for Vegas itself.

Now the building's gutted husk waited for the final signal from the explosives subcontractor, Phoenix, Md.-based

Controlled Demolition Inc. (CDI), which had spent weeks painstakingly distributing 428 pounds of explosives among strategically chosen girders and columns inside the 1,550 rooms of the squat nine-story East Tower and the 32-story West Tower, and connecting them with just under two miles of caution-yellow detonating cord.

At 2:33 a.m., an elaborate four-minute fireworks tribute filled the sky over the Stardust. When it was over, a pyrotechnic countdown exploded down the taller building's façade while the crowd chanted along like it was New Year's Eve. With a seismic rumble, the 356-foot-tall West Tower elegantly folded in on itself. The simultaneous collapse of both towers took less time than the actual countdown, leaving only a rising wall of fat black clouds and screaming car alarms.

Implosion is the fine art of causing a building to collapse down into its own

Controlled Implosion Theory

In the aftermath of the attacks of Sept. 11, 2001, a conspiracy theory made its way through the world: Towers 1, 2 and 7 of the World Trade Center fell by controlled implosion rather than as a result of the two passenger jets that smashed into the buildings.

The proof, the conspiracy theorists charge, was in plain sight: The collapse of all three buildings was swift (Building 7 came down in 6.5 seconds) and uncannily symmetrical; the buildings sank vertically into their respective footprints; and the demolition was total, culminating neatly in a three-story rubble pile. Theorists point to a natural tendency of tall buildings to topple to the side, not into their own footprints.

Steven E. Jones, a physicist at Brigham Young University, lent scientific credibility to the theory when he hypothesized that the culprit was the controlled detonation of military-grade explosives, rather than fires caused by the two planes. But although many agree that the features of the WTC collapse bore resemblances to a controlled implosion, the theories stop at “how.” Debunkers generally have the last word.

In a 2006 report, Protec Documentation Services expert Brent Blanchard tried to put the conspiracy to rest. As part of planned demolition projects, Protec had portable field seismographs in place around several sites in Manhattan and Brooklyn on 9/11. Blanchard says they did not show the “spikes” that would normally have been caused by a chain of explosions in the towers.

The last word came in the form of a spring 2008 report released by the National Institute of Standards and Technology on the collapse of World Trade Center Building 7. Three years in the making, the report concluded that the building collapse was attributable to fire, not debris damage or engineered demolition. The destruction of WTC 1 had caused a small fire that burned out several floors of Building 7. That fire caused thermal expansion in the building’s beams, and the expanding beams in turn detached girders from the main columns. Overloaded, the columns collapsed, several floors pancaked (similar to what happens in implosions after the charges are detonated) and the building collapsed.

The 33-year-old, iconic Veterans Stadium in Philadelphia was imploded in a record 62 seconds on March 21, 2004, and replaced with parking lots for the city’s new sports facilities.

footprint, as if a black hole in the middle absorbed its mass. After the dust clears, the debris looks like much less than the sum of the former building’s parts. The physics of it looks so improbable as to be unreal.

Not all demolitions are implosions; only a few require the extreme containment that implosion imparts. Demolition, the less expensive way to bring down a building, involves cranes, wrecking balls and bulldozers, and might take weeks or months to complete.

Implosion is done for three main reasons, says Anna Chong, president of Engineered Demolition, a blasting company in Coeur d’Alene, Idaho. Implosion is best when a building is either particularly tall, has to come down on a tight schedule, or has delicate surrounding structures. “Cost is a big factor,” she says. “The taller the building, and the tighter the surrounding buildings, the more costly a demolition will be.”

In Las Vegas and other densely packed cities, the point of implosion is to contain as much of the mess as possible. As such, the implosion of a tall building is a bit like a supersized magic trick. Spectators are momentarily dazzled by a physics-defying display but the technical acumen and months of grueling preparation that go into its planning are hidden.

Making Magic Look Easy

Like any good magic trick, an implosion is planned long before the theatrics. The average implosion takes under 10 seconds. The preparation takes five months.

The original Stardust opened for business in 1958 as a nine-story, 109-foot building, and was augmented with the 32-story, 356-foot tower in 1989. The doors closed for the last time on Oct. 31, 2006.

In 2006, Stardust owner Bill Boyd hired CDI as the blaster and LVI Environmental Services of Nevada to be the demolition contractor. LVI, whose



subsidiary promotes itself as the nation's largest remediation firm, managed the site before, during and after implosion. It took care of the asbestos abatement, deconstruction and hauling—everything except the actual implosion.

Behind the Scenes

The first step in any tall building implosion is to strip the building down to its bare essentials, concrete and steel. The most important part is asbestos abatement—LVI hauled more than 100,000 square feet of asbestos-contaminated material out of the Stardust. The last thing any site owner wants is liability for massive clouds of asbestos dust floating through the city.

The contractors have to remove as much of the building material as possible to minimize the chances of explosive projectiles flying out during the implosion. “No one has any conception of how fast this material is moving, until that air blast thumps them in the chest,” says Brent Blanchard, field operations manager for Protec Documentation Services Inc., a demolition consulting firm in Rancocas, N.J.

Once the building has been stripped, structural engineers are brought in to determine where best to plant the charges. They pore through architectural blueprints, examine the naked support and decide which explosives to use and where to put them. In rare cases, they use computer-based simulations, but Blanchard says those are rarely useful. “Structures are never built the way they were supposed to be built—never,” he says. “It takes a person to walk through there and literally look at every column, a person who knows what they’re looking for. They can’t be replaced by computers.”

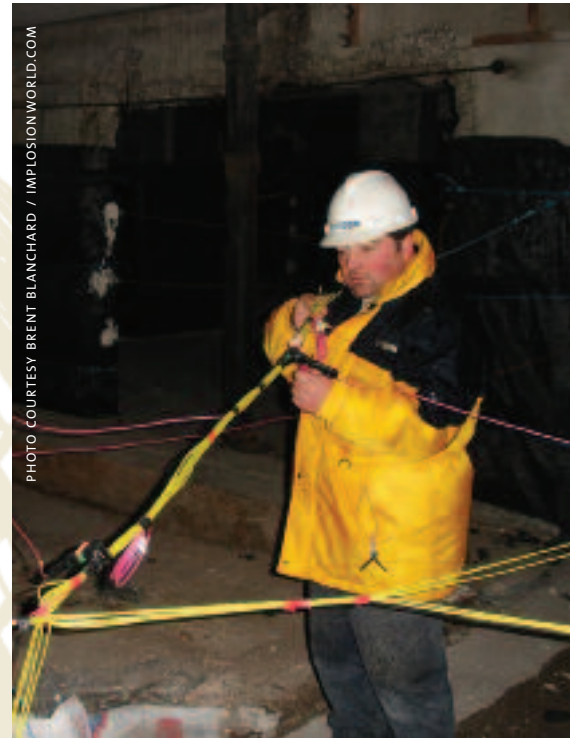
Blasters tend to work bottom up; they raze the major support columns on the lower floors first and follow up with a few of the higher floors. The Stardust’s smaller East Tower was typical of a 9-

story building: only the first two floors needed to be wired with explosives to bring the whole structure down. That’s how implosion works: it collapses one section, which weakens and collapses the section above it, and onward until the center can no longer hold.

The structure also needs to be weakened to prepare it for the implosion, so all non-weight-bearing walls are taken out. The crews notch columns and walls to make sure they succumb easily: after all, a building is not brought down by the explosions—these only weaken the supports so that gravity can do its job. Then more holes are drilled into the columns to hold the explosives.

Methods depend on where in the world a building is being imploded. Most U.S. buildings use either steel beams or concrete columns filled with steel-reinforcing bars (rebar). [For more information about how skyscrapers are built, see the fall 2007 issue of *BOSS* at www.dixonvalve.com.] Buildings in the U.K. are often constructed with shear wall, a kind of concrete not usually supported by rebar. Demolition is trickier. “You have to be careful or you’ll shoot the concrete everywhere,” Blanchard says. Elsewhere in the world, the concrete is less dense and supportive. In Greece and Malaysia, for example, Blanchard says, “If you rub the concrete hard enough on the ground, it will turn into powder. It’s very unsafe. That’s why you see all those buildings collapse when there’s an earthquake.”

Rebar doesn’t respond to the same explosives as concrete. Concrete is no problem for conventional dynamite, which is just absorbent stuffing saturated with combustible chemicals. Once ignited, the burning chemicals quickly generate a massive amount of hot gas. That expanding gas creates enormous outward pressure, up to 600 tons per square inch, which sends a supersonic shock wave through the column and splinters it into tiny chunks.



A worker inspects detonating cord connections before a blast in Glasgow, Scotland.

Steel beams, by comparison, are more complicated. “Steel is a lot riskier,” Chong says. Severing them requires cutting the steel, which can only be done with a specialized high-velocity explosive called RDX, which is stronger than dynamite. Contractors affix the RDX in shaped charges to the steel beams. When it detonates, the shock wave tears the steel at a rate of 27,000 feet per second. The addition of a smaller amount of regular dynamite provides a nudge that encourages the beams to collapse in the right direction. Each baited floor of the Stardust’s West Tower had 56 concrete supporting columns, which were perforated with 882 narrow holes. Another 339 were punched into the columns of its shorter sibling for a total of 1,221 holes. On the day of the demolition, the bore-holes would receive their volatile payload: 856 sticks of nitroglycerin dynamite, connected by a long fuse to a detonator hundreds of feet away from the building.

Detonating cord is a flammable core inside a flexible plastic casing. As per cartoon physics, the contractor ignites one end, and the steady-burning flame travels along the cord until it hits the detonator at the other end, where it sets off the primary charge. The burn rate of detonating cord is incredibly fast, but also predictable, ensuring the exact timing to control multiple detonations. But once the detonator is triggered, there’s no going back.

The First Blast

The 700-year-old Holy Trinity Cathedral in Waterford, Ireland, was the first recorded explosive demolition, razed in 1773 with 150 pounds of gunpowder. Explosive demolition came to the United States around the 1850s. In its attempts to save San Francisco from a rash of fires, the local government ordered the demolition of any buildings that might fuel the fire’s path. Later, Alfred Nobel came up with a stable, less volatile derivative of nitroglycerin that has since become practically a synonym for explosives: dynamite. [For a biography on Alfred Nobel, see the summer 2008 issue of *BOSS* at www.dixonvalve.com.]

After World War II, blasters discovered they could control the direction of a building’s fall and minimize ground vibrations—by turning one massive explosion into a staggered series of several small explosions. By the late 1940s, movie newsreels showed large structures collapsing in dense urban areas without so much as grazing anything around them. In the 1960s, RDX was added to the menu of explosives.

A convergence of technological improvements meant better explosives, better modeling and an accumulation of experienced blasting companies that had been working with explosives for decades. By the 1990s, implosion was a spectator sport. Because of the impressive physics of the operation, implosions drew major crowds. A decision that had



Apartments that were never completed are imploded in Bari, Italy, in 2005, below left. A worker connects detonating cord to explosives placed on a column in the Continental Bank building in Fort Worth, Texas, below right.



PHOTO COURTESY BRENT BLANCHARD /
IMPLOSIONWORLD.COM



PHOTO COURTESY BRENT BLANCHARD /
IMPLOSIONWORLD.COM



PHOTO COURTESY ANDREW FERGUSON / [HTTP://ANDREWFERGUSON.INFO](http://andrewferguson.info)

Fireworks lit up the sky above the Stardust Resort & Casino as interior dynamite charges began to bring down the landmark, above.

The average implosion
takes under **10 seconds.**

The preparation
takes **five months.**

Demolition ... Quiet and Slow

Implosion's claim to fame has always been that it is the fastest and comparatively cleanest. But in 2003, a Johns Hopkins University study showed that the dust lingered, causing health concerns for surrounding neighborhoods. "It caused a bit of a buzz when it came out," says Brent Blanchard, operations manager for Protec Documentation Services. "Yes, they are harmful if you stand right next to them and breathe a lot. But you have to compare it to other methods of bringing that building down."

Last year, however, Japanese construction company Kajima Corp., headquartered in Tokyo, debuted a floor-by-floor demolition technique, called daruma-otoshi, that is anything but fast and media-friendly: a piecewise, controlled dismantling that takes a building apart like a game of Jenga. "Our method can reduce noise and dust from demolition work," says Kajima spokesman Satoshi Shigematsu. "It is also easy to recycle the materials from the building's interior."

Here's how it works: the crew knocks out the walls of the ground floor and replaces the support pillars with hydraulic metal columns. Once all the original supporting pillars have been replaced, a computer carefully and very slowly retracts the telescoping pillars until each floor has sunk to ground level. The effect is that of the building being swallowed by the earth in excruciatingly slow motion.

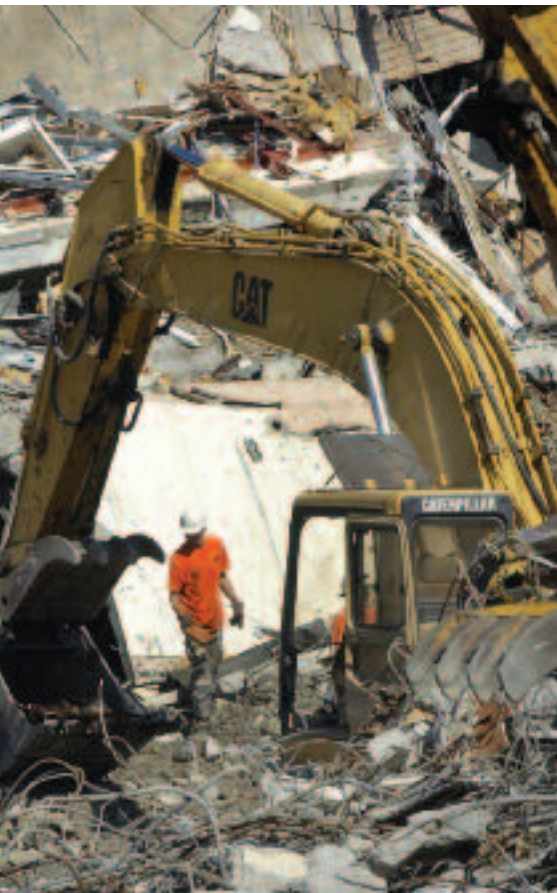
Shigematsu says the company removes asbestos and other hazardous materials at the same time the demolition of the bottom floor is happening. "It's hard to say which methods are more efficient," he says. "However, our method may be able to reduce some demolition period because we always remove interiors, separate and carry our waste materials from the ground floor instead of demolishing a building from the top floor with heavy equipment."

According to the company, a contractor could harvest and recycle 99 percent of building materials, since it avoids the mash-up of inseparable rubble that follows every implosion and sometimes makes it impossible to reliably recycle the steel and concrete. Overall demolition time can be cut by 20 percent as compared to demolition and implosion, and it reduces environmental contamination.

"If you have a ton of cheap labor, that's probably the way to do it," Blanchard says. "But I can't imagine it being cost-effective in the U.S."



PHOTO COURTESY ANDREW FERGUSON / [HTTP://ANDREWFERGUSON.INFO](http://andrewferguson.info)



Both Stardust towers crumbled into their own footprints as gravity took over, above. The rubble left in the aftermath of an implosion can take months to clean up, left.

previously been based on cost and logistical factors was now influenced by the warm glow of media coverage. Implosion started to draw its own fan base.

Blasters became minor celebrities, sought for television interviews and documentaries. “We are deluged with media inquiries on a daily basis,” says CDI Project Manager Stacey Loizeaux. Chong says her company has been in the media spotlight as well, especially while advising the government of Canberra, Australia, after one of the worst engineering disasters shook the country and implosions virtually disappeared from the media’s glare.

On a Sunday afternoon in July of 1997, the seven-story Royal Canberra Hospital and its four-story nursing dormitory, Sylvia Curley House, were imploded to make room for the National Museum of Australia. The government was insistent on this timely implosion and had extended an official invitation to the public. The 100,000-plus who showed up formed the largest crowd in Canberra’s history.

Twelve-year-old Katie Bender was at the show with her parents. Tens of thousands of spectators thronged along the shore of Lake Burley Griffin to watch the display on the other side. When the hospital came down at 1:30 p.m., a 2-pound steel fragment ricocheted about 1,400 feet across the lake, killing Katie instantly.

A subsequent inquest found that the people in charge had no experience with implosion. The investigation, in which Chong’s company provided expertise to legal counsel, found that several columns on the ground floor of the hospital’s main tower block were not fully sandbagged—including two columns from which the forensic examiners deduced the fatal shard came. After the Canberra disaster, almost overnight, implosions worldwide stopped being promoted as tailgate parties. Though these events still manage to attract thousands, now, specific dates and times of implosion events are seldom announced far ahead of time.

When CDI gave the sign at 2:37 a.m. to implode the Stardust Resort & Casino, four members of the Boyd family, owners of the building, pushed down the plunger on a theatrical detonator right out of an old Western film.

The aftermath of the implosion left 38,000 tons of rubble—about 2.5 feet of concrete and steel per floor. LVI spent two months cleaning up the rubble and preparing the site for the June 19, 2007, groundbreaking for the \$4 billion Echelon Resort, slated to open in 2010.

But one part of the Stardust will live on. The light bulb-encrusted, 18-story sign that stood in front of the hotel will be preserved at Las Vegas’ Neon Museum.

The giant sign had to be painstakingly disassembled wire by wire. Ultimately, dismantling the sign took just under a week and restoring it is estimated to cost more than \$1 million—a much slower and more expensive endeavor than imploding its namesake hotel. ■

FACTS & FIGURES

By the Numbers: Implosion Records

Record Tallest Structure Imploded

NUMBER 1,217 feet
WHAT CBC Transmission Tower (FM and TV transmission mast for Canadian Broadcasting Co.)
WHERE Shawinigan, Northern Quebec Province, Canada
WHEN 2001

Record Shared Most Structures Levelled in a Single Detonation

NUMBER 20
WHAT Stelco Steel Plant
WHERE Hamilton, Ontario, Canada
WHEN 1997

NUMBER 20
WHAT Bow Valley Medical Center hospital complex
WHERE Calgary, Alberta, Canada
WHEN 1998

Record Tallest Free-Standing Structure Imploded

NUMBER 906 feet
WHAT Matla Nuclear Power Station Smokestack
WHERE Johannesburg, South Africa
WHEN 1982

Record Longest Implosion

NUMBER 62 seconds
WHAT Veterans Stadium
WHERE Philadelphia, Pa.
WHEN 2004

Record Most Explosives

NUMBER 12,000 pounds of explosives
WHAT Sears Merchandise Center
WHERE Philadelphia, Pa.
WHEN 1994





Father of the Modern Age

Prolific inventor Nikola Tesla's influence on the world is incalculable, yet often overlooked

BY SARAH ACHENBACH

Nearly every ordinary, modern-day occurrence—flicking on a light switch, listening to the radio, watching television and wirelessly surfing the Internet—is the result of the extraordinary Nikola Tesla, the 19th- and early 20th-century inventor and engineer who fathered the second industrial age and heralded the wireless age.

The holder of 700 patents worldwide, he forever altered the fields of electricity and magnetism. He wrote of scientific devices far ahead of their time, including the idea of using high-frequency radio waves underwater to detect ships—one of the first introductions of radar—and piloting remotely wingless aircraft loaded with bombs. When the computer field's integrated circuit developers tried to file patents for basic logic gates on silicon, they were astonished to learn that Tesla beat them to it at the turn of the 20th century using AC-based components. Tesla's influence on science and humanity is incalculable. Yet, at the

end of his prolific life, he died penniless, ridiculed and nearly forgotten by the world he literally illuminated.

Born on July 10, 1856, in Croatian Krajina to a Serbian Orthodox priest father and a mother who invented a mechanical eggbeater and other household appliances, Tesla began inventing at an early age. He was only 5 when he created a working prototype, designing a paddle-less waterwheel that spun evenly in the current. In high school, when he saw an engraving of Niagara Falls, he announced that, one day, he would go to America and harness the falls' energy with a giant turbine.

In 1881, forced to give up his electrical engineering studies at the Polytechnic Institute in Graz, Austria, due to a lack of funds, Tesla joined the Budapest telephone company as an engineer. At the time, Thomas Edison's direct current (DC) technology was widely used for generating electricity. With DC, electrical current flowed continually in one direc-

tion, and though recognized as inefficient—it could not handle high and low voltages or transmission between user and generator greater than two miles—no one had been able to design an alternating current (AC) motor. That would soon change after the 26-year-old Tesla took a walk in a Belgrade park with a friend in 1882. "... The idea came like a flash of lightning and in an instant the truth was revealed," he wrote. "I drew with a stick on the sand the diagram shown six years later in my address before the American Institute of Electrical Engineers."

His design for an AC induction motor using a rotating magnetic field that changed direction at a constant angular rate laid the foundation for the field of electro-magnetism. Like all his ideas and inventions, this discovery sprung from mind to stick in perfect detail, as Tesla possessed the remarkable cognitive ability to completely visualize an invention in his head and tran-

scribe it fully realized onto paper. Unable to rouse any backing with his successful prototype in Europe, he set sail for America in 1884 after Edison hired Tesla to work in his West Orange, N.J., laboratory.

Each day, the tall, stately Tesla arrived for work in a formal, full-length jacket and top hat, a habit that annoyed Edison, though Edison was impressed with his abilities and asked Tesla to redesign his DC generator. Tesla claimed that Edison verbally promised him \$50,000 payment, but when the young Serbian presented a vastly improved design a year later, Edison told him, "You don't understand our American humor." Tesla immediately resigned and left for New York City, broke but not broken.

To keep from starving, he worked for a time digging ditches before A.K. Brown of the Western Union Co. financed Tesla's application for 40 basic

U.S. patents on his cost-effective, efficient polyphase AC system generators, motors and transformers. After Tesla's 1888 AIEE presentation, industrialist and inventor George Westinghouse purchased Tesla's patents for \$60,000 and hired him as a consultant.

Edison did not take lightly Tesla's success or the introduction of reliable AC-powered generators as competition to DC. The ensuing war of currents included Edison's smear campaign, declaring that "just as certain as death [AC power] will kill a customer within six months." In addition to lobbying and leaflets, Edison paid his technicians to use AC to publicly electrocute stray dogs and cats, farm animals and even a circus elephant.

Meanwhile, Tesla, who became a U.S. citizen in 1891, and the Westinghouse Corp. beat General Electric, the company backing Edison, to create a "City of Lights" at the 1893 Chicago World's Fair, the world's first all-electric fair. Tesla's AC system won over the 27 million fairgoers. One convert was Lord Kelvin, the British physicist and head of the international Niagara Falls Commission, who post-Fair asked Westinghouse Corp. to tackle Tesla's childhood dream of harnessing the power of Niagara Falls. On Nov. 16, 1895, the switch was flipped on the first hydroelectric power plant in Niagara Falls. Miles away, electricity surged into Buffalo, N.Y., streetcars, and the long-awaited project was a success. Tesla, the darling of the scientific community and international press, enjoyed his celebrity by hosting lavish dinner parties at his home in the old Waldorf-Astoria Hotel.

The war of currents, with its prolonged litigation, had left Westinghouse and GE in dire financial straits. GE also struggled after its purchase of Edison's company. Westinghouse, meanwhile, was on unsure financial footing with investors due to Edison's propaganda and Tesla's very generous royalty agreement of \$2.50 for every horsepower of AC equipment sold. At George Westinghouse's request, Tesla famously tore up the agreement in a grand gesture of thanks to the man who gave him his

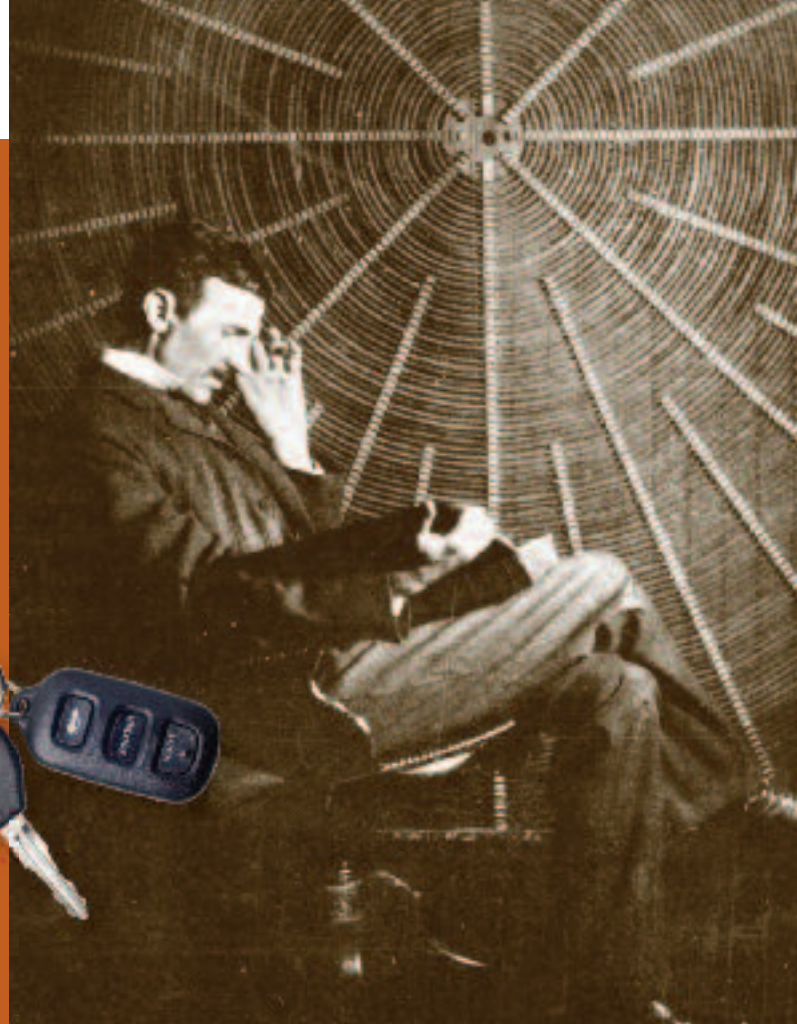


An observer sits in Tesla's Colorado Springs laboratory near his magnifying transmitter while it generates high voltages in the form of 23-foot-long electrical arcs, below.



Some of Tesla's Inventions

- Rotating magnetic field
- Polyphase alternating current (AC) induction motor
- Fluorescent light
- Tesla Coil used in radios, television sets and other electrical devices
- Wireless communications and transmission of electrical energy
- Remote control
- Robotics
- Terrestrial stationary waves
- Radio
- Electric car
- Vertical takeoff aircraft
- Bladeless steam turbine



Tesla in front of his spiral coil's high-frequency transformer at his laboratory on East Houston Street in New York, above.

start. Though publicly lauded for his genius and even though his AC system quickly became (and remains) the standard for generating and transmitting electricity, Tesla would struggle financially the rest of his life.

In 1895, a fire consumed Tesla's New York City lab, a disaster made all the more difficult with the awarding a year later in England of the first wireless telegraphy patent to an Italian inventor, Guglielmo Marconi.

Tesla was granted a U.S. patent for the basic radio in 1900, and Marconi's subsequent U.S. patent applications were rejected. But with financial backing from Marconi's family, Edison and Andrew Carnegie, the Marconi Wireless

Telegraph Co., Ltd., founded in 1900, thrived in the stock market. In 1904, for reasons never explained, the U.S. Patent Office suddenly reversed its previous decision and awarded Marconi a U.S. patent for the invention of radio. Five years later, Marconi won the Nobel Prize. An infuriated Tesla attempted to sue for copyright infringement, but he could not afford the litigation.

He returned to New York later that year and immersed himself in his futuristic vision of a world of wireless communication, piquing the interest of "robber baron" J.P. Morgan, who offered Tesla \$150,000 to construct a transmission tower powerful enough for the job. Unfortunately, Morgan prematurely cut

off funding for Tesla's massive *Wardenclyffe* on Long Island. Marconi was transmitting radio signals across the Atlantic Ocean without a massive tower; Tesla accused his rival of using his patents to make the transmissions but Morgan would not reinstate the funds. The project continued from 1901 to 1905, but the cut-off of Morgan's funding in 1904 and a lack of other willing investors ultimately spelled doom.

Unable to fund it himself, Tesla abandoned the incomplete tower in 1905 after producing only a few remarkable light displays. The press dubbed it "Tesla's million-dollar folly," and Tesla suffered a nervous breakdown after being publicly ridiculed again.

Though some of his experiments made him fodder for the press, throughout his adult life, Tesla's intellectual prowess and productivity earned him a worldwide reputation as a genius. Both Columbia and Yale universities

The holder of 700 patents worldwide, Tesla forever altered the fields of electricity and magnetism.

awarded him honorary doctoral degrees, and he was honored by numerous scientific organizations.

On his 75th birthday in 1931, *Time* magazine printed his photograph on its cover. But as his eccentricities grew, so did questions of his sanity. Celibate throughout his life, Tesla lived in increasing seclusion in New York hotel rooms. He ranted in the press against Albert Einstein, and comic book creator Max Fleischer even used Tesla as the inspiration for his mad scientist in the Superman series.

Tesla also became obsessed with pigeons and spent hours in New York's parks feeding the birds. He rescued injured pigeons, an odd habit given his hand-washing compulsion and aversion to germs. At the Hotel New Yorker, where he lived during the final decade of his life with a "Do Not Disturb" sign posted permanently on his door, he often brought pigeons home and asked the hotel chef to prepare a birdseed recipe of his own creation.

In 1934, Tesla made front-page headlines once again with his claim of a new invention of inexhaustible energy that could be transmitted wirelessly across the world.

Using his discovery of a protective radiation principle or "peace beam," as he preferred to call it, Tesla proposed a system of beam weapons along the U.S. and European borders to prevent attacks.

He was unable to secure financing for the prototype, so in

1937, with Europe on the brink of war, Tesla mailed his drawings to the Allied nations, thus providing—free of charge—the first technical specifications of the modern charged particle beam weapon.

Just after Tesla's death of heart failure on Jan. 7, 1943, the U.S. Patent Office restored Tesla as the rightful patent-holder for the invention of the radio, reversing its previous decision.

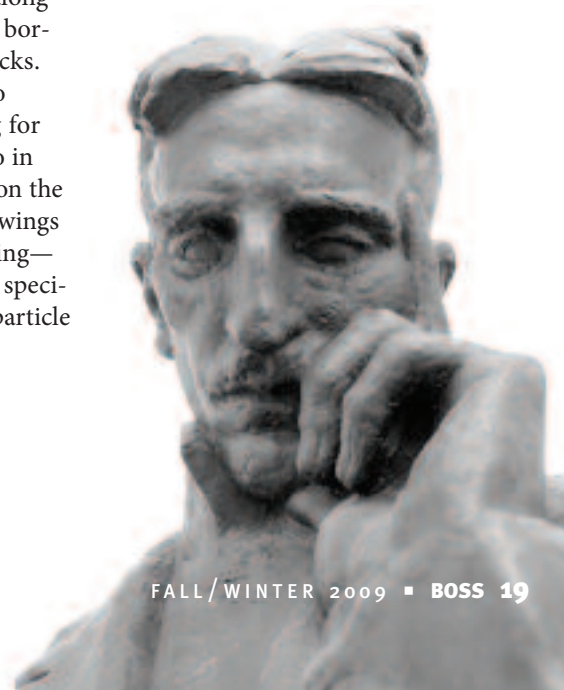
The day after Tesla died, his nephew, Sava Kosanovic, discovered that many of his uncle's technical papers and journals had disappeared from Tesla's hotel room. They have never been found. Two days after Tesla's death, the U.S. Office of Alien Property impounded his remaining belongings. In 1952, the U.S. government returned them to his family, and today his belongings and remaining papers are housed in the Nikola Tesla Museum in Belgrade, Serbia.

Memorials now abound to the father of the modern age—from postage stamps, statues and street signs to the AIEE's prestigious Nikola Tesla Award and an International Unit of Magnetic Flux Density, the "Tesla Unit" ($T=W/m^2$), upon which all MRI machines are calibrated.

The influence of Nikola Tesla's genius is perhaps best embodied in the accolades given to him at the height of his fame, in 1917 when he received the Edison Medal, the most coveted electrical prize in the United States. "Nature and nature's laws lay hid by night," said B.A. Behrend, AIEE vice president, in his award remarks. "God said, 'Let Tesla be' and all was light." ■



The Wardencllyffe Tower was named after western banker and lawyer James S. Warden, who offered Tesla 200 acres to build his wireless communications tower.



PARIS





The City of Light is a walker's delight filled with art, magnificent architecture and delectable treats on almost every corner

BY SANDRA MCKEE

I love Paris—from the heights of Montmartre and the Eiffel Tower to the depths of the city's sewers (yes, you can tour Les Egouts de Paris, on the left bank at Pont de l'Alma), I simply adore the place.

So my husband, Chris, and I took a trip to Paris. His first. My 12th or so. I've been lucky over the years to work for a company that sent me there almost every year for a decade, for a week or two at a time.

But when we went recently, it was the first time I'd been in eight years. I'd missed it. But what I had loved about the city was still there to be loved.

Paris, the look of it, doesn't change. It's big, bold and beautiful. Full of graceful elegance and an almost indescribable feeling of—what?

OK, *joie de vivre!* Love of life. So cliché. So true.

How can a city filled with so many massive buildings still give the air of lightness of being and spirit? I have no idea, but it does. When it is referred to as the City of Light it is a reflection not only of its art, social awakenings and actual lighting of its most important and impressive buildings, but of its very structure and core.

Hemingway found a virtual "Moveable Feast" there, telling a friend, "If you are lucky enough to have lived in Paris as a young man, then wherever you go for the rest of your life, it stays with you."

And it does, even if you're only lucky enough to visit at some point in your life.





French architect Jacques Ignace Hittorff designed the elegant and intricate fountain in Paris' Place de la Concorde in 1836, upper left. The grand Arc de Triomphe, honoring those who fought for France, stands at the end of the Champs-Élysées, lower left. Notre Dame Cathedral in the heart of Paris is widely considered one of the finest examples of French Gothic architecture in the world, below.



The city, its people, its architecture, its art, bakeries and cafés—whether or not Marie Antoinette actually said, “Let them eat cake!” the French seem to have followed the directive wholeheartedly.

Bakeries abound. Le gâteau chocolat (chocolate cake) is readily at hand. One of my favorite places for something warm to drink with a decadent pastry is Angelina's near the Tuileries, at 226 Rue de Rivoli. I was introduced to it years ago, while covering the French Open, by another hot chocolate lover.

They serve a thick, decadent chocolat chaud and an even denser “Mount Blanc torte.”

There is joy in Paris. The Eiffel Tower, which twinkles in tiny blue lights after 10 p.m. The Champs-Élysées, with its tree-lined sidewalks and graceful facades. The Musée d'Orsay, a redesigned train

station, inside and out is a marvel and contains an extensive collection of impressionist masterpieces. The simple apartment building at the bottom of the steps leading to Place du Tertre, where you can find a square full of artists ready to sell you a painting of Paris or sketch your portrait, is charming with its creamy exterior and wrought-iron balconies.

You can enjoy lunch in an open window of a nearby café. The square, just feet from Sacré Coeur, one of the most beautiful basilicas in the world, is surrounded by cafés offering indoor and outdoor seating from where you can watch the painters and the crowd.

There is serenity in Paris. You can find it behind Notre Dame Cathedral, on the Ile St. Louis, having dinner or just eating an ice cream cone from the famous Berthillon shop while sitting on a bench

Petit Course in French

Non-French-speaking visitors can fare quite well in Paris, but the natives appreciate you at least making a bit of an effort. Here is the short-list of French phrases that will come in handy:

Parlez-vous anglais, s'il vous plaît?
Do you speak English, if you please?

Merci.
Thank you.

Merci beaucoup.
Thank you very much.

Les toilettes?
Oui-oui won't get you directions to a restroom but this will.

C'est combien ...?
How much is it?

Bonjour.
Good day.

Bonsoir.
Good evening.

—Chris Zang



or strolling along the Quai de Bourbon. On the evening we were there, the small bridge that leads to the island, Pont St. Louis, was closed to traffic and a French quartet was playing American jazz, as people sat in nearby cafés or on the sidewalks to listen. Some folks just strolled by, tossing a few euros in the open guitar case laying on the street.

The peacefulness of Paris can also be found while sitting in the garden at the Musée Rodin at 79 Rue de Varenne. Or in the Tuileries Garden, with its low-slung iron chairs surrounding a reflecting pool and backed by trees that turn golden in the fall. It's located just off the Place de la Concorde, near the Musée de l'Orangerie, which is home to Monet's original "Water Lilies," and other impressionists' works.

There is the liveliness of Paris in the Marais, where tourists and locals both enjoy good food and the narrow, winding streets. And the Latin Quarter, where jazz can be found.

There also is the happiness that comes from long walks, even on brisk days like we experienced. Stroll the Champs-Élysées, drop in at classic perfume maker Guerlain or at the all-American Gap.

Of course, Paris is known for its fine food. Pick up a quick ham and cheese sandwich at the Paris version of a sub shop or sit at an outdoor café for lunch. Or, if you have time, enjoy a meal at one of the city's many wonderful restaurants. We had two memorable meals.

One, a three-hour lunch at a small establishment about a 10-minute walk from the Eiffel Tower called Restaurant de La Tour at 6 Rue Desaix. It was the best meal of the entire trip, served graciously and warmly by the husband and

Make reservations to dine several months in advance at the Jules Verne atop the Eiffel Tower.



Getting there: Paris has two major international airports—Charles de Gaulle (CDG) and Orly (ORY). Both are easily accessible to Paris by taxi, bus or subway (the RER). Most major airlines make the trip and most flights from the United States leave in early evening, which means you arrive in early morning, usually between 8 a.m. and 10 a.m.

Getting around: While Paris is a walker's dream, not everyone wants to two-step around the town. The subway system is easy to navigate and will take you anywhere quickly. Taxis are everywhere, and often the best choice for getting back to your hotel late at night. Though the bus system can be a challenge, buses do travel several good sightseeing routes. There are Seine River cruises—day and night. And, if you don't mind being with tour groups, you can take Cityrama Tours, which will transport you everywhere from Notre Dame to Versailles. You can usually find information about all of these at your hotel.

Trains are also easily accessible for day trips beyond the city. You can find French railroad information before you go at www.sncf.com.

When to go: May is ideal. In May, the tourists are beginning to arrive, but the summer deluge hasn't arrived just yet. The weather is usually mild, around 68 degrees Fahrenheit (20 degrees Celsius). In early August, temperatures are in the mid-70s to low-80s F (24-28 C) and the city enjoys its smallest crowds of the summer. The Parisians go on their own vacations in August, which means some restaurants are closed—and some museums, too, but the major museums are open.

September and October are beautiful, but the weather can be iffy, swinging from weeks of sunshine to cool and rainy.

The City of Light glows during the Christmas season.

What to see and do: Paris is made for walking. If your time is limited and you want to hit the high spots, start early in the morning at the Arc de Triomphe and then head straight down the Champs-Élysées. You will see the finest of French stores and will pass lovely restaurants and gardens, emerging at the Place de la Concorde, where Louis XVI and Marie Antoinette lost their heads during the French Revolution. Be careful here, as you make your way across or around one of the most amazing traffic circles in the world. Continue straight on to the Louvre and beyond to Notre Dame. Then collapse in a historic old restaurant on the Ile St. Louis, directly behind the grand cathedral.

Where to eat and drink: It seems a restaurant, bistro or patisserie beckons around every corner in Paris.

Try Les Deux Magots at 6 Place, St. Germain des Pres, for breakfast.

Locals like La Fontaine de Mars, 129 Rue St. Dominique, for dinner. It's typically French on a tiny square with closely wedged tables.

The lively Marais offers a smorgasbord of choices; Ile St. Louis has a main street filled with atmospheric restaurant choices and ice cream shops.

Where to stay: It is the small Paris hotels that usually make a stay most interesting to the adventurous. Guidebooks like Rick Steves' *Paris* will lead you to many relatively reasonably priced ones, like Hotel du Champ de Mars near the Eiffel Tower, or you can also try SmallandElegant.com to find more elaborate ones.

Paris also has a selection of large and popular tourist hotels. Check the major American chains, like Holiday Inn, Best Western and Courtyard, among others. They all have multiple Paris hotels. Holiday Inn, for instance, has the Garden Court at 24 Rue de Miromesnil, in the 8th arrondissement.

Scaling upward, Hilton, Marriott, Hyatt chains are also represented. Marriott's Rive Gauche Hotel and Conference Center near the Latin Quarter, at 17 Boulevard Saint Jacques, may be one of the largest, while the Park Hyatt-Vendôme, near Place Vendôme and the Parisian fashion district, one of the most chic.

How can a city filled with so many massive buildings still give the air of lightness of being and spirit?

The stunning Pont Alexandre III bridge spans the Seine River. Decorated with ornate Art Nouveau lamps and sculptures, it is the most extravagant bridge in Paris, below.



wife who own the restaurant in a cozy dining room with walls and woodwork in the yellow and blue colors of Provence.

The other, a five-hour dinner that was a completely different experience, at Le Grand Colbert, 2-4 Rue de Vivienne. For those who saw the Jack Nicholson, Diane Keaton movie *Something's Gotta Give*, the name may be familiar, as it is the site of the scene in Paris where Nicholson has come to announce his love for Keaton only to have Keanu Reeves beat him to the punch.

Le Grand Colbert is 19th-century Paris, a golden brasserie. It's located in a historic building with frescoes and brass railings reflecting the golden light that emanates from street lamp-like fixtures that lead you through the dining room. It's a big restaurant with a cozy atmosphere and friendly service.

I think you could spend a lifetime seeing Paris. But the nice thing about it is that you can be happy just seeing a little. And while the dollar exchange may be steep, the price of getting around town can be very inexpensive.

Though you might hope for a companion with less appreciation for walking than me, Paris is a city made for the long walk.

You can leave your hotel in early morning and walk the day away. There's a wonderful boxed set of books called *Paris, 50 Adventures on Foot* by Christina Henry de Tesson and travel writer Rick Steves' *Paris 2008* offers suggestions for walks around Paris for one to seven days and nights.

But with or without such directions, Paris is a walker's delight. All you need is a street map and desire to see the city. It is all out there, waiting for you. ●



Tips from a Local

Armel Deslandes came to Paris to look for a summer job in 1989 and never left. That first summer he worked as a hotel night security officer. He's still working in a hotel.

When we spoke, he was the head concierge at the Paris Hilton, about two blocks from the Eiffel Tower. He is still the head concierge in the same hotel, but it has been sold and is now the Pullman Paris Tour Eiffel.

"I love Paris for its spirit," he said. "Paris is a very free city with lots of opportunity. You live here and you live in the meeting place ... but to find the joy, you have to communicate."

While there is more English being spoken in Paris these days, it is still true that in the minds of the French, "Bad French is better than no French" when trying to communicate.

Deslandes says, "Paris is a city to get lost in. It is the best way to discover the city."

But if you are a traveler who prefers a plan, Deslandes describes that Paris is divided into 20 independent neighborhoods called *arrondissements*. They are numbered consecutively, spiraling out clockwise from the Louvre and almost every one of them holds something of interest, though the heart of the city, its famous sights and museums, are mostly within a five-block walking distance of the Seine River, which splits the city in half—*Rive Gauche* (Left Bank) and *Rive Droite* (Right Bank).

A good place to start for both the eyes and the taste buds, says Deslandes, is Paris' most familiar sight: The Eiffel Tower.

"The best way to see the tower is to go for lunch or dinner," he says. "That way you avoid the lines by being able to go directly up



A view of the Tuileries Garden reflecting pool located near the Place de la Concorde.

to the restaurants—Altitude 95, which is 95 meters above sea level, or the Jules Verne, which features the cooking of Alain Ducasse, one of the most famous cooks in France and the world."

Deslandes advises to book the Jules Verne at least three months in advance and Altitude 95 up to a month ahead of time. The prices, about \$200 per person at Altitude 95, and \$400 per person at the Jules Verne for lunch, reflect the location.

But there are other, more reasonable places. Deslandes suggests checking out the city's open air markets. One of his favorites is open on Sunday morning, the "Creation" Market in Montparnasse.

And, if time permits, he recommends a day trip to Versailles.

"Go see where France came from, what it evolved from," says Deslandes, who was born in the Brittany region. "It is definitely something special. The home of Louis XVI and Marie Antoinette.

"I love Paris," he says. "And I am quite optimistic about the enchantment of its daily life."

—Sandra McKee

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A Sea Change for World Trade: The Construction of the Suez Canal

“This enterprise would cut in half the distance between the Orient and the Occident. Anyone preoccupied with questions of civilization and progress cannot look at a map and not be seized with a powerful desire to make disappear the only obstacle interfering with the flow of the commerce of the world.”

—*Ferdinand de Lesseps, proposing the construction of the Suez Canal*

BY EUGENE FINERMAN



A hundred miles of sand and rock were the only physical barrier that separated the Mediterranean Sea from the Red Sea and the Indian Ocean, but that desolate isthmus impeded world trade. Ships sailing from Europe to Asia had to go south around Africa, a detour of 6,000 miles. Looking at the map would suggest an obvious and practical alternative; indeed other men—including Napoleon—had speculated on the construction of a canal across the isthmus of Suez. But Ferdinand de Lesseps (1805-1894) did more than theorize. His vision, audacity and vanity created the Suez Canal.

Ironically, the builder of the Suez Canal was not an engineer. De Lesseps was a diplomat. He served as the French consul in Cairo from 1833 to 1837, and during that time he made a lasting friend in Mohammed Said, a prince of Egypt's ruling family. De Lesseps resigned from the diplomatic corps in 1849 and retired to his rural estate in France; but he had loftier ambitions than agricultural management. As he confided to his mother-in-law, "I want to do something great, without hidden motive, and without personal interest in money." He saw the need for a Suez Canal, and he could count on one invaluable ally in such a project. His friend Said now was the heir apparent in the ruling family of Egypt.

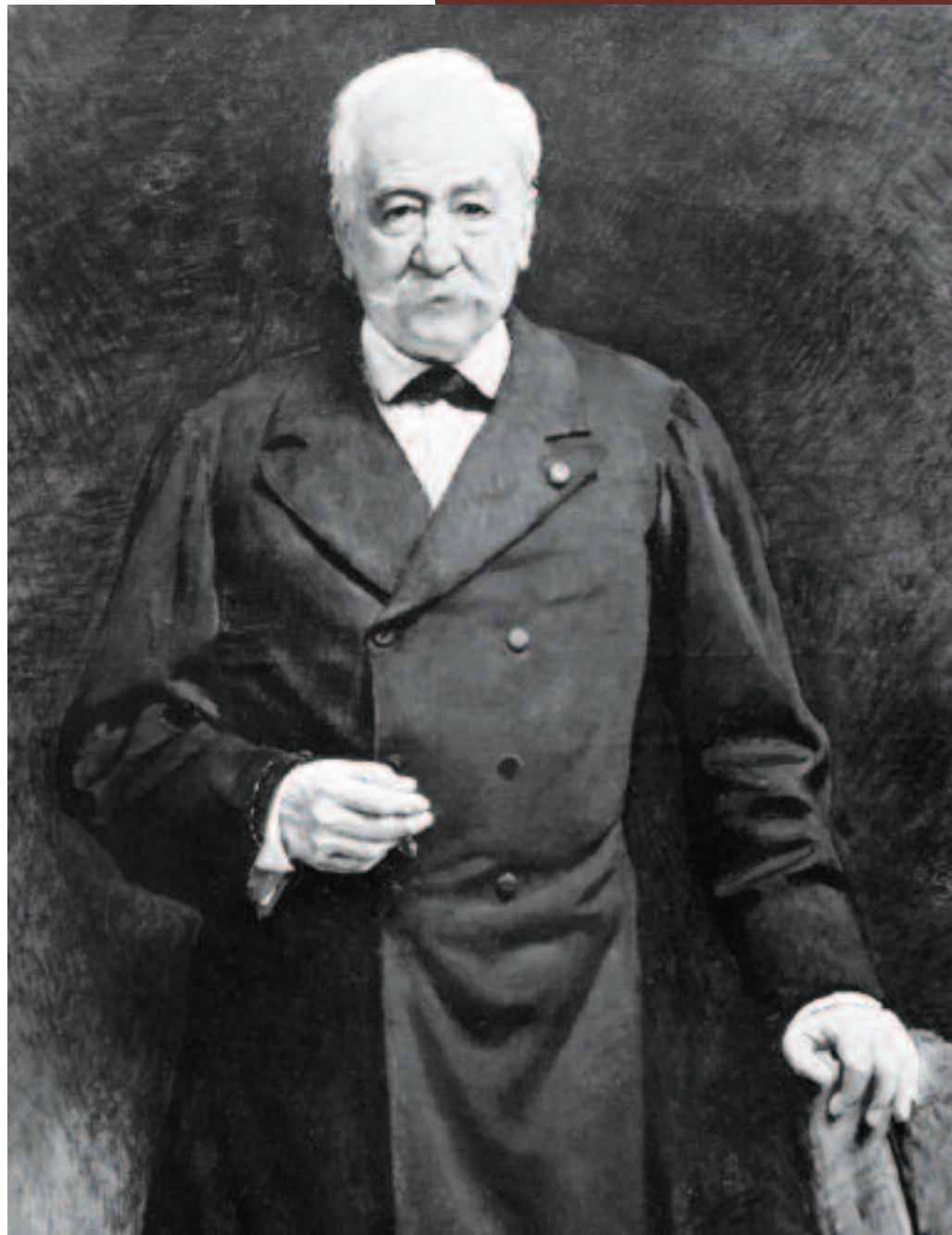
Said became the viceroy of Egypt in 1854, and de Lesseps was soon in Cairo presenting his proposal. His experience as a diplomat made him a talented salesman. De Lesseps first enumerated the practical advantages of a Suez Canal. It would strengthen and enrich Egypt, making the country a center of world trade. Then de Lesseps appealed to Said's vanity. "The names of the Egyptian sovereigns who erected the Pyramids, those useless monuments of human pride, will be ignored. The name of the prince who will have opened the grand canal through Suez will be blessed century after century for posterity." Finally, de Lesseps promised to undertake all of the laborious chores while Said could just sign decrees and get rich.

Of course, Said agreed. De Lesseps received exclusive rights to construct and manage the Suez Canal. To assist in the project, Egypt would waive all import taxes on supplies and equipment, it would provide quarries for construction materials at no charge and it would provide a work force of laborers. Said issued the decree on Nov. 30, 1854; but it would be 4 1/2 years before the construction actually began.

De Lesseps simply looked at the map to decide the route of the canal. It would be a 100-mile channel, extending from the Mediterranean Sea directly south to the Red Sea port of Suez. But such a monumental undertaking required



French diplomat Ferdinand de Lesseps died in 1894 at the age of 89.





As ships approached Port Said's entrance, they were greeted by a large statue of Ferdinand de Lesseps, which was destroyed on Dec. 24, 1956, as a symbol of Egyptian patriotism.

Over a year, 720,000 peasants were part of the work force; and the total population of Egypt was only 4 million.

investors, and de Lesseps had to persuade a wary public that the proposed canal would be both feasible and profitable. He welcomed scientific and engineering evaluations of the project; he was confident their findings would verify his claims. Indeed, they did. In its evaluation, the French Academy of Sciences approved of de Lesseps' plan and added it seemed a bargain. At the same time, de Lesseps was conducting a one-man public relations campaign. Fluent in a number of languages—including English—and with a diplomat's charm, he traveled from Russia to Britain, meeting with businessmen and politicians to promote the idea of a Suez Canal.

In 1858, de Lesseps was ready for business, launching the Suez Canal Co. and offering stock to raise money. Initial studies estimated that the cost of constructing the canal would be 200 million francs (or \$40 million in 1858 dollars). That would be the equivalent of \$1.1 billion today. The initial public offering proved disappointing, however. Only 56 percent of the stock was purchased. Said agreed to buy the unsubscribed shares.

The construction finally began in April 1859. In addition to digging and blasting through 100 miles of sand and rock, the canal required the construction and dredging of a deep-sea harbor at the northern end of the canal. The new Mediterranean port was tactfully named Port Said. The Egyptian government had promised to provide the work force, and it did so by forced labor. Sixty thousand peasants each month were coerced into working on the canal. They were obliged to spend two months, although half of their time was spent traveling to and from the project. Over a year, 720,000 peasants were part of this work force; and the total population of Egypt was only 4 million.

The reports of this forced labor appalled Europe's public. Britain and France had outlawed slavery, and serfdom had been abolished throughout most of Europe. Public opinion did not see the difference between those forms of servitude and forced labor. The Suez Canal Co. attempted to defend the practice as a tradition of Egypt; the same

practice that had built the Pyramids. De Lesseps vowed that the workers were paid, fed and sheltered—as if that would mitigate the fact that they were forced to work on the canal. But this bad publicity did not stop the construction.

The death of Viceroy Said did. De Lesseps' old friend died in January 1863 and was succeeded by his nephew Ismail. The new viceroy did not oppose the idea of a canal, but he did resent de Lesseps' control of the project. Ismail wanted to renegotiate the terms of the agreement; to put pressure on de Lesseps, Egypt halted the supply of laborers. Without the workers, construction on the canal halted. But de Lesseps had the contract, and its terms could not be so arbitrarily amended. In those days, there was no World Court to settle such matters. However, Louis-Napoleon Bonaparte III, the emperor of France, offered to arbitrate the dispute. Ismail accepted but he could not have picked a more biased judge. De Lesseps was regarded as a hero in France, French investors had a major stake in the Suez Co., and de Lesseps happened to be the cousin of Eugenie, the wife of Louis Bonaparte. As if there could be any doubt, the French emperor decided in de Lesseps' favor. If Ismail refused to supply laborers for the project, then he had to provide the funds for de Lesseps to employ other workers.

With that money, de Lesseps purchased machines to replace the manual labor. These machines, powered by coal or steam, were designed to excavate and extract specific and various types of soil in the Suez. Between 1864 and 1869, the Suez Co. used 300 such machines, operating them 16 hours a day. A year had been wasted during the dispute with Ismail, but the machines more than made up the lost time. Constructing the canal required the removal of 74 million cubic meters of soil, sand and rock; and the machines did more than 75 percent of the work. As the project neared completion in October 1869, de Lesseps and a now cooperative Ismail occupied themselves in planning the festivities to celebrate the opening of the canal.

On Nov. 17, 1869, nearly 15 years after Said issued the decree, a flotilla of

vessels embarked from Port Said on a leisurely, three-day journey through the canal. Starting the procession was the ship bearing the French delegation led by Eugenie, empress of France and—no doubt—de Lesseps' favorite cousin. Other royal yachts carried the emperor of Austria-Hungary and the crown prince of Prussia. The flotilla stopped at Ismailia, the midway station along the canal, and the guests disembarked for a day and a night of lavish festivities: feasts, a ball and fireworks. The next day the flotilla proceeded to Suez for further celebrations. A train then took the royal guests back to Cairo for yet more extravaganzas, including another ball and a horse race at the Pyramids.

And with that, the Suez Canal was in business, charging ships a toll of 25 francs (\$5 in 1869 dollars or \$137.50 in today's dollars) for each ton of cargo. However, the business did not live up to de Lesseps' predictions, the shareholders' expectations or Ismail's financial needs. In 1870, fewer than 500 ships passed through the canal; de Lesseps had anticipated 10 times that traffic. The shares of the canal stock had lost half their value, and the government of Egypt was looking at a terrible shortfall in the anticipated revenues.

Heavily in debt, Ismail was obliged in 1875 to sell Egypt's shares in the canal. The British government was quite happy to buy them; the world's greatest maritime power soon gained control of the Suez Canal. As for de Lesseps, his next project was to build a canal across Panama; unfortunately for he and his investors, the challenge of Panama required an innovative engineer rather than a charming diplomat. The building of the Panama Canal would not be accomplished in his lifetime.

But the Suez Canal was a success, and time has proved de Lesseps a prophet. The canal now is a main thoroughfare of world trade. In 2007, 18,000 ships sailed through it with cargo amounting to 7.5 percent of commercial sea trade. De Lesseps had told Viceroy Said that the man who built the Suez Canal would be honored by posterity. He was right. 🟡



In 1956, the 4,000-ton minelayer, *Manxman*, cruises the Suez Canal, below. Between Port Said and Ismailia, an Egyptian patrol ship travels through the canal, bottom.



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An operator controls a core drill rig at an iron ore mine site near Port Hedland, Australia.

It's Not My Problem

Correcting workplace problems immediately keeps everyone safe

BY PHIL KIMBLE

In today's fast-paced world, people don't stop if they can keep going. Even if we see something that is not right, we don't often take initiative to change it. It's easy to take the attitude that it's someone else's problem. Sometimes there is a price to pay for an "it's someone else's problem" attitude.

A core drill rig is a complex piece of equipment. There are various styles and methods in which a core drill rig can drive a drill bit into the ground in search of minerals or water. One of the more common types is a pneumatically driven rig. In essence, this style of rig is a giant air compressor mounted on a truck frame with a boom containing the drill bit and connecting pipe. In some instances, the operator's platform is right next to the boom. The air, at very high

pressure and tremendous volume, rotates the drill bit while a ram simultaneously drives the bit into the earth. When exploring for minerals, air also blows the cuttings back up to the surface for examination by a geologist. These rigs, when in operation, are noisy, dirty and have a tremendous amount of vibration.

At one such mineral exploration site, the core drill rig operator was operating the rig controls from his platform. He only had one more hole to drill before his shift was over when he noticed two of the four bolts were missing from a clamp. This clamp holds the air hose at the connection to the drill pipe, which blows the cuttings up to the surface. When the drill pipe is in its lowest position, this air line connection is only a few feet from the operator. Having

changed these clamps before, he knew this task would be time consuming and would keep him at work late. Besides, he thought, why should he be bothered with this at the end of his shift when the next operator can deal with it at the beginning of his? He loaded the next length of drill pipe and continued drilling.

With the drill pipe nearing its lowest position, the clamp, in its compromised condition, could not hold onto the hose any longer. In an instant the hose was out from underneath the clamp. It sounded like a cannon, rattling the windows at the site office several blocks away. The whipping hose struck the operator, throwing him more than 20 feet and causing severe injuries.

When something needs attention, especially in the workplace, take the time to correct the situation, or communicate with someone who can. Your time is no more valuable than your co-workers'. By not taking corrective measures when a problem is identified, you are putting yourself and others in harm's way. ■

THE DIXON DRILLER

DECEMBER 2009

"Published once a moon since 1932"

TRIVIA Did you know that...

The first computer mouse was invented by Doug Engelbart in 1963 and was made of wood.

Astronauts cannot burp in space.

The Pacific entrance of the Panama Canal is farther east than the Atlantic entrance.

Forest fires move faster uphill than downhill.

Bill Gates' house was designed using a Macintosh computer.

U.S. scientists calculated that Santa

would have to visit 822 homes a second to deliver all the world's presents on Christmas Eve, traveling at 650 miles a second.

A coffee tree yields about 1 pound of coffee in a year.

Milk is heavier than cream.

The 7-Eleven Extreme Gulp is 50 percent bigger than the volume of the human stomach!

All of the Earth's continents are wider at the north than in the south.

Months that begin on a Sunday will always have a 'Friday the 13th.'

Of the six men who made up the Three Stooges, three of them were real brothers (Moe, Curly and Shemp).

Rubber bands last longer when refrigerated.

The chance of you dying on the way to get your lottery tickets is greater than your chances of winning.

(<http://www.funfactz.com>)

ON THE LIGHTER SIDE

A little boy returned from Sunday school with a new perspective on the Christmas story. He had learned all about the Wise Men from the East who brought gifts to the Baby Jesus. He was so excited he could hardly wait to tell his parents.

As soon as he arrived home, he immediately began, "I learned all about the very first Christmas in Sunday school today! There wasn't a Santa Claus way back then, so these three skinny guys on camels had to deliver all the toys!

"And Rudolph the Red-Nosed Reindeer with his nose so bright wasn't there yet, so they had to have this big spotlight in the sky to find their way around!"

As a little girl climbed onto Santa's lap, Santa asked the usual, "And what would you like for Christmas?"

The child stared at him open-mouthed and horrified for a minute, then gasped: "Didn't you get my e-mail?"

A burglar broke into the house of a Quaker in the middle of the night and started to rob it.

The Quaker heard the noise and went downstairs with his shotgun.

When he found the burglar he pointed his gun at him and said gently, "Friend, I mean thee no harm, but thou standest where I am about to shoot!"

Dates in History

1888

On Dec. 23, Dutch painter Vincent van Gogh, suffering from severe depression, cuts off the lower part of his left ear with a razor while staying in Arles, France. He later documented the event in a painting titled "Self-Portrait" with Bandaged Ear. Today, van Gogh is regarded as an artistic genius and his masterpieces sell for record-breaking prices; however, during his lifetime, he was a poster boy for tortured starving artists and sold only one painting.

1932

On Dec. 27, Radio City Music Hall in New York City opened. The 60-foot-by-100-foot stage was designed with a sophisticated system of hydraulic-powered elevators, which allowed spectacular effects in staging. Many of its original mechanisms are still in use today. It remains the largest indoor theater in the world.

(<http://www.history.com>)

Product Spotlight

CAM & GROOVE REDUCERS

Dixon offers a variety of reducing cam and groove fittings for many applications. These fittings are available in aluminum, brass and stainless steel. Some products may be manufactured as welded fabrications and identified as such in the Dixon catalog. Reducing couplers and adapters are produced to interchange with all products produced to commercial item description A-A-59326B. For complete details and availability call 877-963-4966 or visit us online at www.dixonvalve.com.



Product Safety

No Cam and Groove coupling system should ever be used for air, nitrogen or any other compressed gas service due to the decompression of the gases and the hose whip that will result in an accidental opening of the quick-acting arms.

An ongoing program of inspecting cam and groove handles, rings and pins must be in place to eliminate problems. Damaged, missing or broken parts of fittings must be replaced. These parts are durable but not indestructible. Every effort must be made to be certain that no one attempts to use the cam and groove couplings with damaged or missing cam arms.

The ongoing inspection program should also include the gaskets of these couplings to be sure they are not worn or missing. The gasket system must be compatible with the media that flows through the assembly. A corrosion resistance reference guide is provided in the Dixon catalog and also on our Web site under the 'technical' tab.





Run for Your Life!

Well, at least you can run to stay fit—even if you haven't ever done it before. Here's how to get started.

BY MARIA BLACKBURN

Animals run in the wild. Children run on the playground. But adults? Sure, they run to meetings, run programs on their computer or run out to grab a salad at lunchtime. But many don't ever lace up their sneakers, hit the road and run.

They should. Most adults need at least 30 minutes of moderate physical activity at least five days per week, and running provides a good cardiovascular workout in a relatively short period of time. Consider this: If you weigh 155 pounds and run at 6 mph for 30 minutes (about a 10-minute mile) your body will burn 320 calories. By comparison, playing tennis or biking for that same amount of time burns 281 calories.

"I love the efficiency of running," says Josh Levinson, owner of Charm City Run, a Baltimore-based running specialty store and event management company. Levinson runs about 30 miles a week, more when he's training for a race.

"You're hard-pressed to find an exercise that will give you the same benefits that running can give you in just 40 minutes and you don't even have to drive anywhere. You just put on your shoes and you're out the front door."

Some of the physical benefits of running include weight loss, increased coordination and improved cardiovascular and bone health. "In the short term, running benefits how you feel," says Keith Williams, a fellow with the American College of Sports Medicine who is an associate professor of exercise biology at the University of California, Davis. "Running also has potential long-term benefits in how your body responds over time," adds Williams, who studies the biomechanics of running and has served as a consultant to the footwear industry.

And then there's that runner's high that regular runners talk so much about. It's no joke. Last year, researchers at the Technische Universität München and the University of Bonn in Germany successfully used an imaging study to show, for the first time, increased release of endorphins in certain areas of the athletes' brains during a two-hour jogging session. These endorphins are associated with mood changes and can make you feel good.

There are 41 million people in the United States who run, according to a

2008 survey by the Sporting Goods Manufacturers Association, and some 16 million of them run frequently, at least 100 days a year. But running is hardly just an American sport. Every year some 70,000 people run in the 3.5-mile JP Morgan Chase Corporate Challenge in Frankfurt, Germany, making it the largest race in the world. Other races worldwide that draw a huge number of participants include the Cursa de El Corte Ingles 11K in Barcelona, Spain (53,000 participants) and the Stramilano, a no-competition run where more than 40,000 participants have five hours to complete a 12K course through the city of Milan, Italy.

Every single one of those runners had to start somewhere. And with a little guidance, a few pointers and a pair of well-fitted running shoes, almost anyone can join them and become a runner, too. Some things to keep in mind:

Get the right equipment. "We're not built to run on hard surfaces, but that's the place where most people run," Williams says. Buying a good pair of well-fitted running shoes is the first step because they can help prevent injuries. (See sidebar for more information.)

Start slow. "The people who are most likely to get injured are the ones who do too much too soon," says Williams. Start slowly with walking, then short runs, then longer runs. Beginning running schedules like "Couch to 5K" at www.coolrunning.com can help

you. Or if you'd rather do it yourself, remember not to have more than a 15 percent increase in mileage per week, Levinson says.

Set a goal. Maybe you want to run to the library and back or maybe you want to run a half marathon. "Set a goal and work toward it by gradually adding to your mileage," Levinson says.

Have a plan. The worst thing you can do if you've registered for a race is to not have a plan. "You're fine and going to complete it, but you're not well-trained," says Levinson. There are basic training programs on how to prepare for 5Ks, 10Ks and even marathons on the Internet at sites like www.runnersworld.com.

Seek help when you're hurt. "Muscle aches should feel better if you give them adequate time for rest," says Williams. "But if you're experiencing Achilles' tendon pain, heel pain or pain on the bottom of your foot that won't go away, seek a diagnosis." ●



Step Out with the Right Shoes

Running or walking for fitness requires a good pair of well-fitted shoes. Expect to pay an average of \$85 to \$150 for running shoes and expect them to last for about 400 miles of running (and you can wear them for other uses after).

Here are some tips from the American College of Sports Medicine on how to purchase the right pair:

Eighty-five percent of people wear shoes that are too small. Check for adequate room at the top. There should be at least a half inch of space between the top of the shoe and the longest toe. The shoe shouldn't be tight but it shouldn't slide around and your heel should fit snugly into the rear of the shoe.

Try shoes on later in the day and bring the socks you are most likely to run in. Make sure you try on both shoes and keep them on your feet for about 10 minutes to make sure they remain comfortable.

Consider purchasing two pairs of running shoes. Alternating their use increases the life expectancy of each pair.

Consider purchasing shoes at a running specialty store where salespeople are trained in fitting running shoes and there is often a treadmill available in the store so that they can observe how a shoe fits your foot while you are running.

Once you've purchased new shoes, don't try them out for the first time with a 12-mile run or a heavy track workout. The key point is to have sufficient time to break in the shoes.

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Where Did You Get Those Dimples?

The lopsided beginning of the golf ball

BY LISA DE NIKE



What's round, dimpled, white and wildly aerodynamic, but in its infancy was a homely, lumpy leather sphere stuffed with chicken feathers?

The golf ball, that's what.

Historians assert that the very earliest golf balls date back to the mid-15th century, when sportsmen in Holland and Scotland used primitive clubs to whack at hard little clunkers carved from beech or elm wood. Records tell us, in fact, that the Dutch shipped those early balls by the barrel-load across the North Sea to sportsmen in Scotland, which would become the country best known for golf.

It took at least a hundred years for the Scots, fed up with the wooden balls' lack of flight capability, to invent the feather golf ball, or "featherie." Featheries were made by packing a top hat's worth of wet goose down or chicken feathers into moistened cowhide or horsehide casings, which shrunk and hardened as they dried. The resulting slightly lopsided orb was hammered to make it as spherical as possible, and then coated with several layers of paint.

That imperfect and costly orb was used for about 300 years, until the Rev. Adam Paterson of St. Andrews, Scotland, came up with a better idea in 1848: a ball fashioned from a rubbery substance made from the dried juice of

the Gutta tree. These so-called "gutta" balls were fashioned by rolling sheets of the softened material on a board to create an orb and they had the advantage of being easily repaired and reshaped.

Gutties were deliberately imprinted with various patterns, because it had been discovered long before that an imperfect ball had a truer flight than did a more perfect one. The new ball's main drawback was that it tended to break apart in midair, which forced a rule change: players were allowed to play a fresh ball when an old one disintegrated.

As enthusiasm for the sport grew, so did interest in improved equipment. So few were surprised when, in 1901, a new ball—this one with a rubber core, invented by an employee of the Ohio-based Goodrich Tyre and Rubber Co.—made its British debut.

The inventor, Coburn Haskell, figured that wrapping elastic thread tightly around a rubber core and *then* encasing it in a sheet of patterned gutta would make for a very aerodynamic ball, and he was correct! The new ball was made famous when, in 1902, Sandy Herd used it on the Royal Liverpool course to play four rounds in a score of 307 to beat greats James Braid and Harry Vardon by a single shot.

"Dimples" were added around 1908 for improved aerodynamics. Physicists and engineers tell us that the balls

with dimples travel longer distances than their smooth counterparts for two reasons: one, because the uneven surface increases air turbulence in the layer of air directly around the ball, pushing it farther and faster and two, the dimples reduce "drag."

By 1920, both the United States Golf Association (USGA) and the Royal & Ancient, St. Andrews (R & A) began standardizing the sport and its equipment. In 1931, the USGA introduced a slightly larger ball that could weigh no more than 1.62 ounces and have a diameter of no less than 1.68 inches. After claims that the bigger ball was the reason for American golf dominance, the R & A made the ball compulsory for the Open Championship in 1974 and has since outlawed smaller balls altogether.

Today, fans of the links can choose from a dozen types of golf balls in prices ranging from \$5 a ball to \$10 for a dozen balls.

The most common ball on the course is comprised of two pieces: a solid inner core and a hard cover. But increasing numbers of players are using multi-layered balls, made of a core, middle and top layer. And finally, there is a growing assortment of technologically advanced four-layer balls with liquid cores.

Quite an improvement over wet feathers stuffed into an cowhide sphere. ●



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