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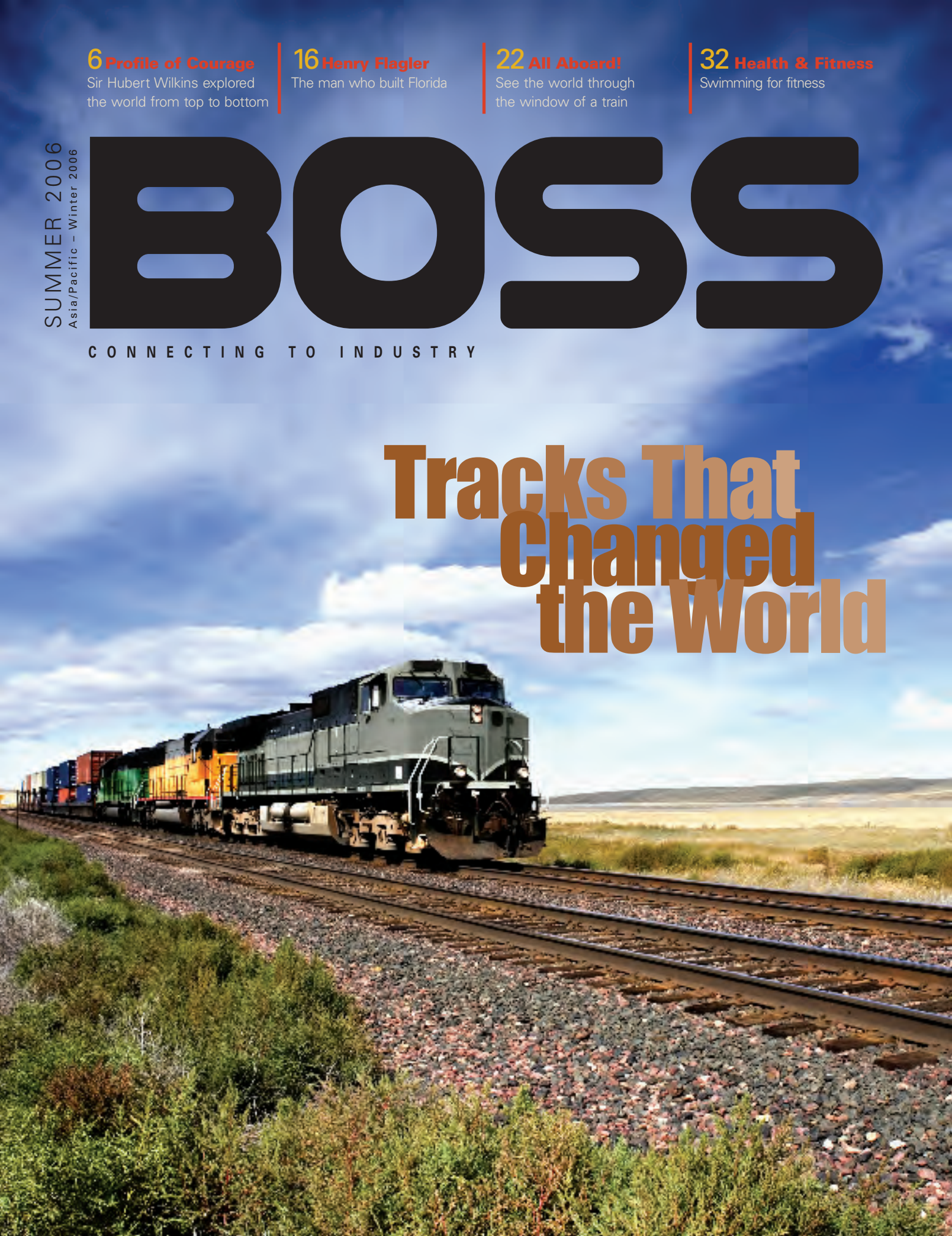
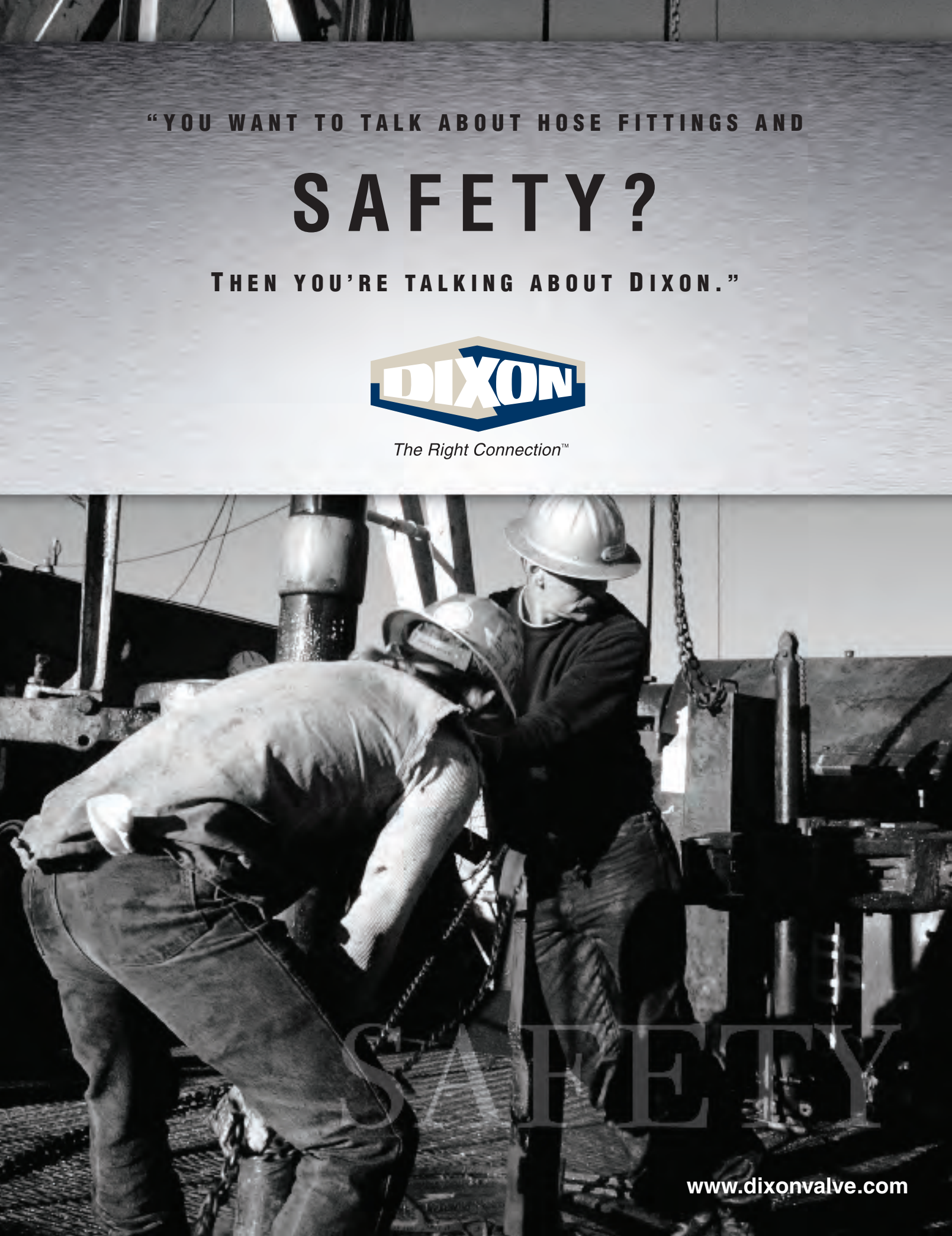
CONNECTING TO INDUSTRY

Tracks That Changed the World

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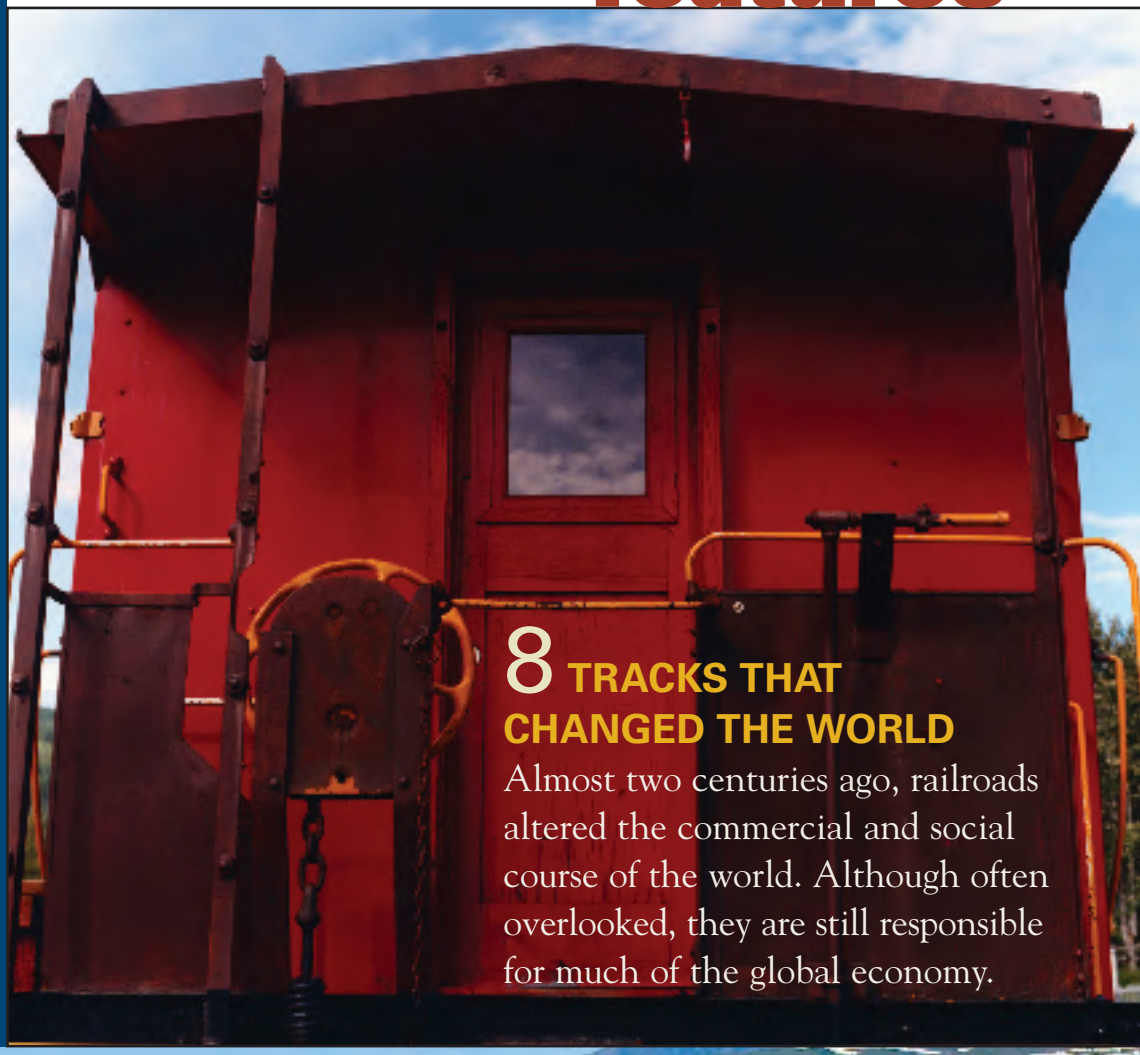

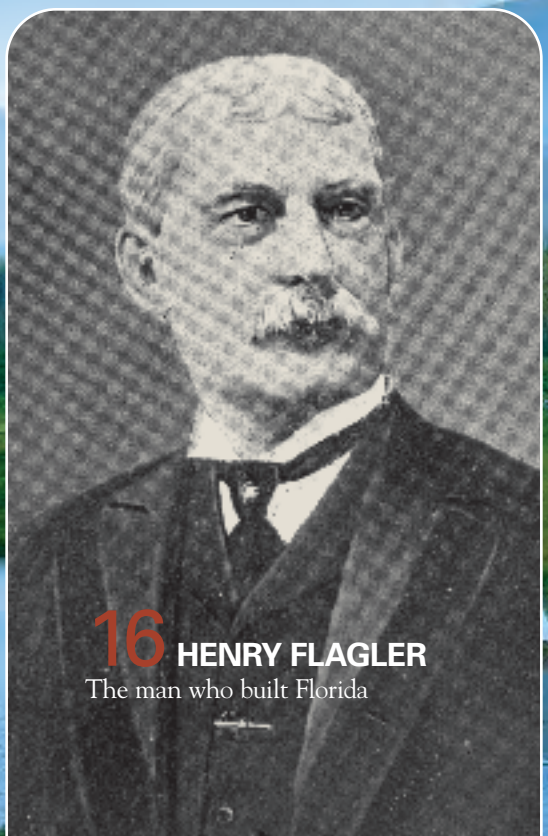

Five Stars

Five stars. The phrase carries a meaning—excellence, flawless service, attention to detail—that people around the world understand.

Members of the Dixon staff recently attended the annual convention of the Association for Hose and Accessories Distribution at the Broadmoor Hotel in Colorado Springs, Colorado. While the focus of these types of events typically includes the discussion of industry trends, sharing of ideas and educational seminars, there are times when attendees also learn unexpected lessons.

Our meeting at the Broadmoor made me reflect on the idea of service. Great facilities such as the Broadmoor have a well-deserved reputation for a quality product and outstanding customer service. The Broadmoor's desire to please its guests is evident in every area of the hotel, and looking around at the improvements and additions in progress, one can assume they are also making a profit.

Success like this doesn't happen by accident. An extensive training program, high standards and a continual review of processes are an integral part of the Broadmoor culture. Taking note of how other companies provide exemplary service, even in unrelated industries, can offer a road map to success for us all.

What the Broadmoor demonstrates as a five-star resort is exactly what we talked about for days at our convention. I wonder what rating each of our companies would receive? Do we spend the time, as the Broadmoor does, training all of our employees? Are we focusing all our efforts on delighting the customer? Do we continually appraise what works and what doesn't, and commit to improving the areas found lacking? If not, we should review all of our policies and strive for the elite status that the hospitality industry craves—a five-star rating.

Thank you,

Dick Goodall

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Australian polar explorer Sir Hubert Wilkins made historic first flights over both the Arctic and the Antarctic in 1928. (Photo by Hulton Archive/Getty Images)

Sir Hubert Wilkins

BY SUE DE PASQUALE

When Sir Hubert Wilkins gazed out the window of his roaring Lockheed Vega on a cold December day in 1928, he was captivated by the natural beauty spread before him. He paused for a moment from the map he was sketching to revel in the vastness of the Antarctic peninsula below. "For the first time in history," he would later pen in his diary, "new land was being discovered from the air."

The Australian-born Wilkins was no stranger to "firsts." Just eight months before, with close friend and aviator Ben Eielson, he had earned a spot in aviation history by being the first to fly across the Arctic. The pair took off from Point Barrow, Alaska, on the morning of April 22, and 20 hours and 20 minutes later landed their tiny Lockheed Vega in Spitsbergen, Norway. The 2,500-mile flight, mostly across uncharted territory, made headlines and earned Wilkins knighthood from Britain's King George V.

The historic flights confirmed what Wilkins had long been advocating: that the airplane would herald a new era of exploration. In a 20-minute period during his flight over the Antarctic, Wilkins sketched a map covering 40 miles — a feat that would have taken three months to accomplish by land party. "I felt liberated," he would later say. "I had a tremendous sensation of power and freedom."

By all accounts, Wilkins was a man of remarkably wide-ranging talents, whose expertise took him on adventures all over the world and often put him directly in harm's way. A photographer and cinematographer, he shot footage and took photographs of the Balkan War in 1912, work that reportedly landed him at one point in front of a firing squad. A self-taught pilot, he served in the Australian Flying Corps during World War I. An able balloon-

ist, he rode helium balloons behind enemy lines in France, photographing nearly every major battle fought by the Australians and earning a Military Cross, as well as suffering exposure to mustard gas. An expert on botany, he served as chief of the scientific staff for the Sir Ernest Shackleton Quest Antarctic Expedition (1921-22) and lived among the aborigines of Australia as commander of a British Museum-sponsored expedition (1923-25).

In addition to these adventures, Wilkins traveled to Russia on a secret fact-finding mission for the U.S. government, flew aboard the Graf Zeppelin II during its trip around the world, was a passenger on the Hindenburg's maiden voyage to the United States, and even found time to get married—to Australian actress Suzanne Bennett.

Pretty heady stuff for a boy who started life in 1888 in remote southern Australia, the 13th child of a sheep-farming family. Young Hubert was a voracious reader, often seen with a book when he was behind the plow. Thirsty for excitement, he stowed away on a ship bound for London at age 20 but was forced off in Algiers — only to be captured by a mob of gun runners, according to some accounts. He would eventually make it to England and embark upon the odyssey of adventures that would take him from the top of the world to the bottom, all within weeks of turning 40.

After his historic polar flights, Wilkins set his sights on achieving another dream: to be the first to reach the North Pole beneath the ice. He purchased a surplus World War I submarine from the U.S. Navy for $1, refurbished it, and christened it the *Nautilus*. Uncharacteristically, Wilkins failed in his attempt, when the old vessel broke down. The necessary submarine technology—in the form of power, underwater range and a navigational system—simply didn't exist at that time to make such a journey possible.

Wilkins would go on to write several books about his adventures and to lecture widely across the United States and the world. After serving on several fact-finding missions for the U.S. government during World War II, he continued as a government adviser until his death on November 30, 1958, at the age of 70. Just the year before Wilkins died, the American nuclear-powered submarine *Nautilus II* achieved his long-held dream when it submerged in the Chukchi Sea on August 1, 1957, and resurfaced in the Greenland Sea three days later.

On March 17, 1959, after a brief (and cold) memorial ceremony, Sir Hubert Wilkins received a fitting farewell when the submarine captain of the *USS Skate* scattered the great explorer's ashes across the North Pole.

Tracks That Changed the World

Almost two centuries ago, railroads altered the commercial and social course of the world. Although often overlooked, they are still responsible for much of the global economy.

Story by Mike Field

They were the defining technology of the 19th century. They form the backbone of modern industrial society. They will become the energy-efficient, low-emissions transport systems of the future. And chances are, they rumble by regularly within only a mile or two of your own front door.

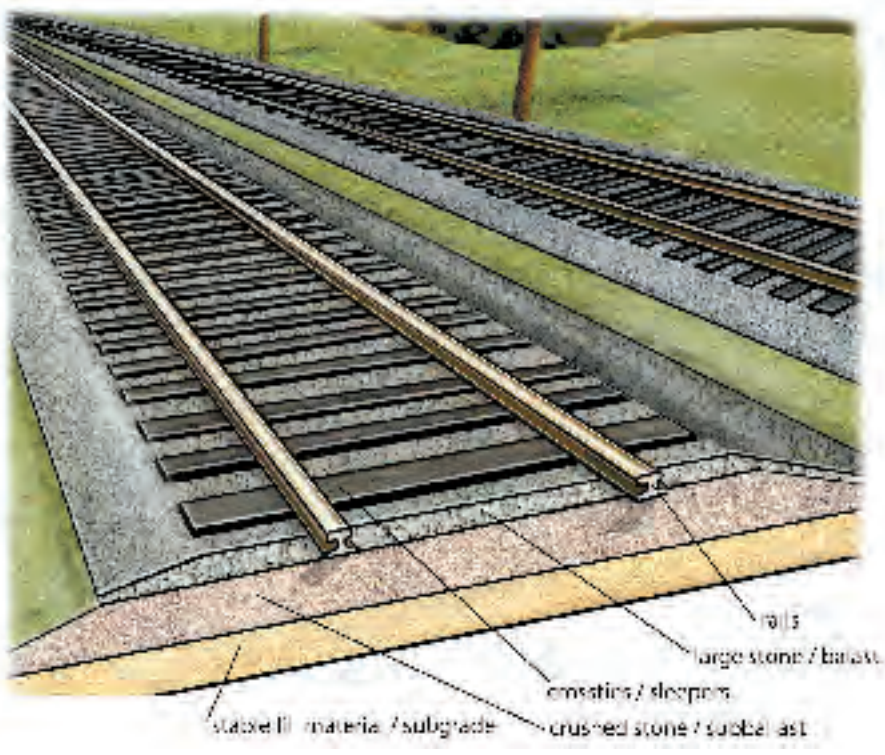
They are the railroads, mighty movers that transformed the modern era.

While recently the world's attention has been focused on computing power and gigabytes, baud rates and bandwidth, the railroads have been quietly going about their business, improving their engines, upgrading their tracks, and steadily advancing their capabilities. The system of rail lines that knit together society beginning in the 1830s is poised to hold together the high-speed global economy of the 2030s—and beyond. Yet ironically, few people today give the railroads a second thought.

"People underestimate how important they are," says Christopher Barkan, director of the Railroad Engineering Program at the University of Illinois at Urbana-Champaign. "The fact is, our society couldn't function without the railways."

The U of I campus is home to the largest railroad engineering academic program in North America, one of a handful of research centers worldwide that are inventing the train systems of tomorrow. Some of those trains are already here.

Yet the basic configuration of railroads—a locomotive pulling or pushing linked cars on a track of parallel rails—



still looks much the same as it did 150 years ago. Those outward appearances are deceiving, however. Almost every facet of the railroad industry has advanced dramatically in the past two decades. From roadbeds and rails, to locomotives and cars, the railways of the 21st century employ advanced technologies that would make them almost unrecognizable to the legendary personalities who invented, built, owned and ran the railroads of the 19th century.

Speed and Efficiency

Innovations in 21st-century railroading are largely focused on safety, increasing speed and improving efficiency. But that has been what railroads have always done best, since the first commercial rail line began carrying both passengers and freight between two English cities—Liverpool and

ILLUSTRATION BY TADEUSZ MAJEWSKI.

Manchester—on September 15, 1830. That date is where some historians draw a line to separate the modern era from all history that came before.

In many ways, the world just prior to trains was little changed from the time of Julius Caesar. In those days, towns and cities were almost always located by a major waterway, since boats and barges were the most efficient form of transport. Over land, a man could go no faster than a horse could run—and then only for short distances. The great majority of people never ventured farther than a few miles from their place of birth. News traveled only as fast as the speediest riders were able to carry it.

The inaugural excursion of the Liverpool-to-Manchester railway was the catalyst for change. The steam locomotives of those days were underpowered and slow, typically averaging just 12 to 15 miles per hour; soon the railroads would regularly sustain overland speeds of 30 mph or more, while carrying ever-larger loads of people and freight. By the middle of the century, they could travel a mile a minute. The modern era had indeed begun.

Now, increasingly, people would travel and work ever farther from home, and make those journeys at ever faster speeds. The range and quantity of goods and services that could be traded quickly and at low cost exploded. Prior to the completion of the first transcontinental railroad in North America, a journey from New York to San Francisco took an arduous six months and cost what was then the hefty sum of $1,000. After the golden spike linking the east- and west-bound rail lines was driven home on May 10, 1869, the same trip took just seven days—and cost $70.

It's All in the Wheels

"Our industry is always looking for better ways to move things," says Mark Davis, spokesman for Union Pacific, one of the oldest and most famous North American railroad corporations. "As a result, there is a near constant change and advancement in the technology we employ."

Yet for nearly 200 years, the fundamental characteristic of a railroad has remained the same. A railway is a mode of transportation in which locomotives and passenger- or freight-carrying cars ride, and stay on, parallel steel rails thanks to a flange, or lip, on their steel wheels. This is the secret that gives trains their unmatched capacity to provide low-cost, heavy-duty transportation. The flanges (which are on the inside of the wheels) guide the train cars and locomotives on the track, creating a self-steering form of transport. The loss of independent steering is more than

Railroad Milestones

1804 – British inventor Richard Tevithick invents the steam locomotive. It runs on iron rails and successfully hauls 10 tons of iron 10 miles.

1814 – British engineer George Stephenson introduces the first steam locomotive, capable of hauling 30 tons at speeds faster than possible with a horse-drawn system.

1828 – Charles Carroll, last surviving signer of the Declaration of Independence, lays the first stone for the Baltimore & Ohio Railroad – the United States' first chartered railroad.

1830 – The Liverpool and Manchester Railway in England becomes the first regularly scheduled steam-driven railway to carry both passengers and freight.

1862 – Former railroad lawyer Abraham Lincoln signs the Pacific Railway Act, authorizing the construction of the first transcontinental railroad.

1868 – The knuckle coupler, which allows rail cars to be joined without putting a rail worker between cars, is invented by Eli Janney.

1869 – The air brake, which automatically applies braking pressure on every car attached to a locomotive, is invented by Union Army veteran George Westinghouse.

1869 – The first transcontinental railway link, uniting California to New York, is completed with the driving of the golden spike at Promontory Point, Utah.

1871 – The 13.7-kilometer Mont Cenis Tunnel connecting France and Italy opens. It took 14 years to build and was twice the length of the world's longest tunnel at that time.

1885 – The first transcontinental rail link across Canada is opened.

1917 – The era of steam begins to end as the first diesel-electric prototype locomotive is produced.

1932 – Britain's Great Western Railway introduces 'The Cheltenham Flyer,' the world's fastest steam train, averaging more than 70 mph.

1964 – The Tokaido Shinkansen, the first of the famed Japanese 'bullet trains', opens between Tokyo and Osaka, running at speeds up to 125 mph and inaugurating the era of high-speed rail travel.

2005 – The Qingzang Railway, connecting China to Tibet, becomes the highest railway track in the world at 5,072 meters (16,640 feet) above sea level.

made up for by the measure of the rolling friction of steel wheels on steel rails, which is extremely low.

As a result, very large loads can be moved by rail with relatively little horsepower—about one horsepower per gross ton, compared to roughly 10 horsepower per gross ton for the typical tractor-trailer you see speeding down the highway. That's a 10-to-1 advantage in efficiency. Measured another way, a standard gauge 40-ton freight car set free at 60 mph on a flat railway would roll for five miles before coming to a rest. A motor truck of the same weight traveling the same speed on a level roadway, by contrast, would come to a stop after only about one mile.

To achieve these efficiencies, however, railroads must give up other things (such as steering) in return. Rail technology imposes certain limitations that never challenged the great road builders of the past. As a general rule, standard gauge railways must be nearly level, rising or falling by less than 4 percent, or four feet of height for every 100 feet of length. A major modern highway, by contrast, will sometimes contain grades of 10 percent (and secondary roads grades of twice that), since rubber wheels on hardened pavement have much higher rolling friction than steel wheels riding rails.

The rails are laid parallel 4 feet 8.5 inches apart, following the precedent of the pioneer Liverpool-Manchester line. Why 4 feet 8.5 inches? Wagons of the day had wheel spacings of this measurement because the ruts in Europe's older roads were about this space apart. Legend has it the measure actually dates back to the Romans for it is about the width of two horses pulling a chariot.

The train wheels riding on those tracks are fixed in a straight axis, which means that track must be laid as straight as possible, with changes in direction achieved by long radius curves measuring only a few degrees over 100 feet of track. A train, unlike a truck, cannot make a sharp turn to the left or right, or wind through a series of hairpin turns.

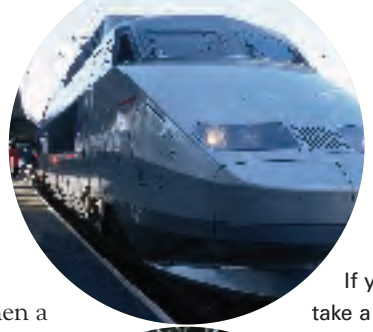
These requirements posed enormous challenges to the railroad builders of the 19th century, so it is no surprise that many of the technological marvels of that day were the bridges, tunnels and other structures that provided the roadbed on which to lay track. Conquering topography has always been the railroads' greatest challenge; once that is done, it is not particularly difficult to build a rail line.

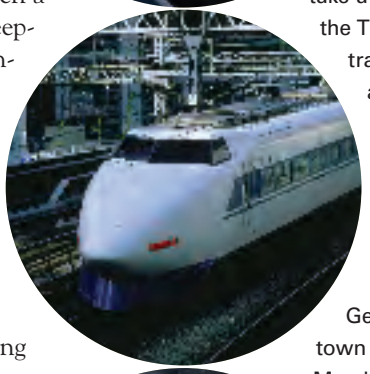
First, a layer of natural soil or stable fill material is leveled and compacted to form a subgrade, and drainage ditches, culverts and other water-control systems are put in place to prevent washouts.

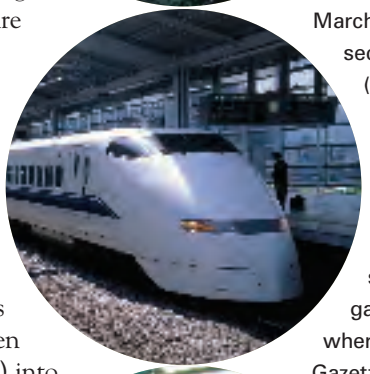
On top of the subgrade, a layer of crushed stone, called the ballast, is laid and smoothed in depths of one to several feet. Then a course of railroad crossties, or sleepers, are laid parallel to one another, transversely across the path of ballast. In North America, wooden crossties treated with creosote predominate; these are spaced 19.5 inches apart. In Europe and wherever wood is scarce, sleepers are now commonly made of reinforced concrete, which has a shock-absorbing pad to cushion the rails. These are spaced on 24-inch intervals.

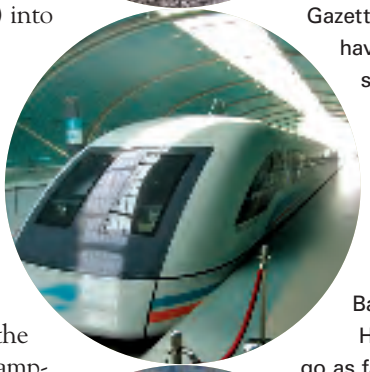
At this point the ties are tamped and leveled to maintain a constant horizontal plane on which the rails are mounted. Metal plates that help distribute the weight on the rails more evenly along the ties are put in place, and the rails are then either spiked (for wooden ties) or clipped (for concrete ties) into place. Nowadays, rails are welded one end to the next in quarter-mile strings, and ground to a clean finish, creating a smooth and continuous ribbon of steel. After the rails have been completely fastened down, a "stone train," which dumps ballast from the bottom doors of specially designed ballast cars, is run over the new rails. Then a computerized tamping/lining machine moves over the track lifting it to the proper grade, lining it horizontally and compacting the stone under the ties—all in one operation. Finally, a ballast regulator plows and sweeps the track to clear out any stray ballast.

One of the unique characteristics of railroads is that the ties









Fast trains, from top to bottom: French TGV; Shinkansen bullet train (two photos); Shanghai Maglev train at station; test of Japanese ultra-high-speed Maglev train; the first U.S. high-speed train, Amtrak's Acela Express.

SHANGHAI TRANSRAPID PHOTO BY YOSEMITE; JR-MAGLEV PHOTO BY YOSEMITE; ACELA PHOTO © CIAN GINTY.

Fast Trains

If you want to go really fast while still on the ground, you need to take a train. And for really fast trains, the place to go is France, where the TGV—in French, le Train à Grande Vitesse, meaning high-speed train—journeys between Lyon-St. Exupéry and Aix-en-Provence at a zippy 263.3 kilometers per hour (164 mph).

Not to be outdone, the Japanese—who invented high-speed train service with the creation of the fabled "Bullet Train" service between Tokyo and Osaka in 1964—currently run a Shinkansen (meaning New Trunk Line) train between Hiroshima and Kokua at 261.8 kilometers per hour.

And in what may be the train technology of the future, a German-built magnetic levitation (Maglev) train line linking downtown Shanghai to its airport 30 kilometers (19 miles) away opened in March of 2004. The train travels point-to-point in seven minutes, 20 seconds, at times reaching a breathtaking 430 kilometers per hour (267 mph). And that may be just a tick of the speedometer: in Japan, an experimental Maglev train recently recorded a speed of 581 kilometers per hour (361 mph), which begins to put trains in the speed range of conventional airplanes.

Freight transport is all about weight and volume—how much stuff can you haul and how often? But for passenger service, the mantra is: How fast can you go? As the 20th century gave way to the 21st, suddenly passenger train systems everywhere were pressing the pedal to the metal. According to Railway Gazette International's 2005 World Speed Survey, four countries now have regularly scheduled train service operating at average speeds of 200 kilometers per hour (roughly 125 mph) or above: France, Japan, Germany and Spain.

More countries are joining the club each year, and more lines are getting faster. France counts six routes that average 250 kilometers per hour (155 mph) or greater; Japan has three. The United States, which lags far behind in high-speed rail, now runs its Acela Express between Wilmington, Del., and Baltimore, Md., at 165 kilometers per hour (roughly 103 mph).

How fast will trains eventually go? In theory, at least, trains can go as fast as planes (indeed, at top speed France's TGV is going twice the speed of a 747 at takeoff) and the current rail vehicle speed record is a face-flattening 10,300 kilometers per hour (6,400 mph) set by an unmanned rocket sled at New Mexico's Holloman Air Force Base in April of 2003.

In reality, however, rail systems are limited not by the speed of their locomotives but by the design of their track way. At speeds of 150 kilometers per hour (93 mph) even curves of a radius of three miles start to feel uncomfortable for passengers (the high-speed Italian Pendolini trains overcome this problem by 'tilting' as they go through curves). In addition, signaling for train crossings and other technical issues tend to limit speeds. At present, only France, Japan, Germany, Spain and South Korea have track ways rated at 300 kilometers per hour (about 185 mph) or above.

are not set in a rigid foundation; they 'float' on the bed of ballast, and as anyone who has stood near a passing freight train can attest, the ties and rails actually flex to a noticeable degree. This is how a comparatively lightweight roadbed can sustain continual traffic of cars weighing 143 tons pulled by 200-ton locomotives, while accommodating large fluctuations in temperature and weather.

The World Bank reports that traffic on the world's railways is extremely concentrated, with the top five national railway systems (U.S., Canada, former Soviet Union, India and China) carrying more than 90 percent of all railroad freight and 56 percent of the passenger load. For a modern economy, the right railroad in the right location can make all the difference.

"Basically, if you are looking for drivers of economic growth—things that increase wealth and drive down poverty—you want to support activities and investments that promote trade," says World Bank transport adviser Paul Amos. "Railroads can do this, but they need to be well-placed and well-managed."

Having a rail line in and of itself does not assure economic prosperity, as countless deserted towns along abandoned rail lines can attest. Says Amos: "There is a great difference between a railroad between two cities of 3 million inhabitants each in China, and a system that meanders through sparsely populated savannah in Africa."

Economic forces in recent decades have resulted in two kinds of railroads around the world: a highly efficient, slow to medium-speed freight transportation system as in North America, or a fast to high-speed (150 mph or more) passenger-carrying system as in Europe and Japan. "It really comes down to the question of whether the rail system is being run for profit—which means freight service—or for passengers and public service," says Amos. "Unfortunately, the two systems don't mix well together."

China, the world's fastest growing economy with the world's busiest railroad system, has had to confront this problem head-on. In the next 15 years, the Chinese plan to invest more than $200 billion in their rail network, and add 25,000 kilometers (15,500 miles) of track to the system. Part of that enormous investment will go to create separate passenger-only rail lines between major metropolitan centers, the first step in creating two rail systems, each with its own set of tracks and equipment. If history is any guide, it will be money, materials and manpower well spent.

Special thanks to Jim Smith for his assistance with this story. Mr. Smith is regional operations director for the Central Region of the Virginia Department of Transportation.

What's the Time?

One little-known but hugely important byproduct of the invention of trains was the standardization of time. In the years before the coming of the railroads—and for all human history up to then—time was strictly a local affair. A town or village generally set time based on the position of the sun relative to the area's tallest structure (often a church steeple).

Not only was this imprecise, but towns 50 or 60 miles apart on an east/west axis would naturally record the sun's apogee, high noon, at a slightly different time (owing to the rotation of the Earth). However, such differences were inconsequential when it took more than two days to travel 60 miles.

With the advent of the railroad, travelers were suddenly faced with the need to reset their timepieces at nearly every stop; train schedules in such a system were all but meaningless. In 1883, American and Canadian railroads simply decreed there would be five standard time zones running across the continent from east to west. In each time zone, on Sunday, November 18, people were required to stop and reset their clocks by anywhere from two to 30 minutes when the railroads said it was officially noon.

That day—which became remembered as "the day of two noons"—proceeded smoothly, but not everyone welcomed the change. In Indianapolis the *Sentinel* complained: "The planets must, in the future, make their circuits by such timetables as railroad magnates arrange … people must marry by railroad time, and die by railroad time."

But the New York *Herald* took a more philosophical approach: "The man who goes to church in New York today will hug himself

with delight to find that the noon service has been curtailed to the extent of nearly four minutes …" Subsequently, a saloon owner in Iowa appeared before the state Supreme Court where he argued that he followed sun time, not "railroad time" and so had not violated closing time laws.

Nonetheless, the practicality of the system was hard to refute. The following year the International Meridian Council met and instituted the system used worldwide today, with Greenwich, England, serving as the prime meridian and 24 more-or-less equally spaced time zones circling the globe from there. In the United States, local time technically remained a local prerogative until the federal adoption of daylight savings in 1918. Internationally, the time zone system was not fully adopted in all major countries until 1929.

Railroads by the Numbers

$179 billion: Worldwide railroad transportation market in 2005 (estimated)

64 percent: Share of the 2005 railroad transportation market for Europe and North America

126 mph: Fastest recorded steam locomotive, the British *Mallard*, on July 3, 1939

361 mph: Fastest recorded speed of a Maglev train, the Japanese experimental MLX01.

149 mph: Fastest recorded diesel-powered train, the British *HST*, on November 1, 1987

129,066: Number of all types of train locomotives estimated by the World Bank to be in service (worldwide) at the start of the 21st century

419: Number of steam locomotives estimated by the World Bank to be in service (worldwide) at the start of the 21st century

1,181,903: Kilometers of railway track worldwide in 1999 (732,780 miles or about 29.5 times around the globe)

1.5 million: Number of people who work for the railroads in India

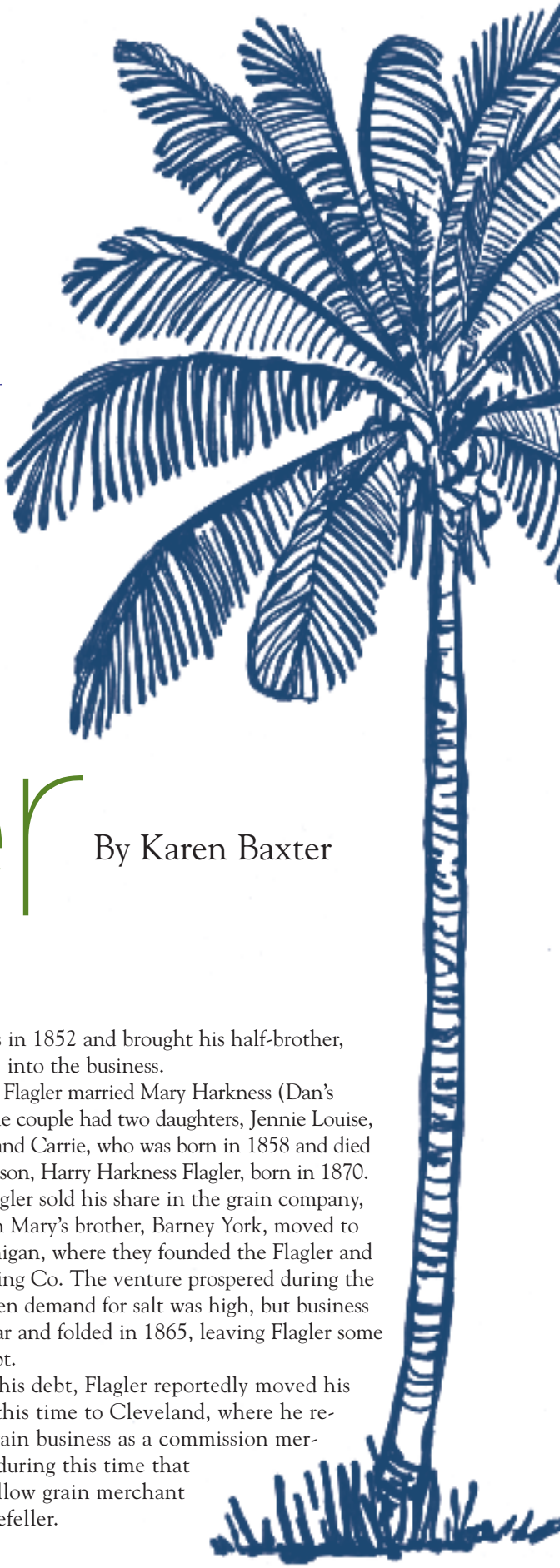
220 million: Weight (in pounds) of the world's heaviest train, which was 4.5 miles long and carried iron ore 171 miles in Western Australia on June 21, 2001, using eight locomotives

50 hours: Time it will take to get from Beijing to Lhasa, Tibet, aboard the soon-to-be-completed Quinghia-Tibet Railway, which will be outfitted with special UV-protected atmospheric cars to accommodate extreme altitudes; four-fifths of the railway is built at 4,000 meters (more than 13,000 feet) elevation

The Man Who Built Florida

Henry Flagler

By Karen Baxter



Henry Morrison Flagler—the son of a poor minister who worked his way to become one of the richest men in America—once described himself as "contented … but never satisfied."

That would explain a lot about the 19th-century oil tycoon, developer and railroad magnate. At 53, a time in his life when most would be happy to sit back and enjoy the fruits of their labor, Flagler was only just beginning to make history and was still to become the "grandfather of Florida tourism."

Flagler was born in Hopewell, N.Y., on January 2, 1830, to a poor Presbyterian minister, Isaac Flagler, and his wife, Elizabeth Caldwell Harkness Flagler.

From an early age, the penniless Flagler had his eyes set on the business world. In 1844, with only an eighth-grade education, the 14-year-old moved to Bellevue, Ohio, to work for the Harkness family in their grain store, L.G. Harkness and Co. After climbing up the ranks in the business, Flagler bought out one of the company's partners in 1852 and brought his half-brother, Dan Harkness, into the business.

A year later, Flagler married Mary Harkness (Dan's cousin), and the couple had two daughters, Jennie Louise, born in 1855, and Carrie, who was born in 1858 and died in 1861, and a son, Harry Harkness Flagler, born in 1870.

In 1862, Flagler sold his share in the grain company, and along with Mary's brother, Barney York, moved to Saginaw, Michigan, where they founded the Flagler and York Salt Mining Co. The venture prospered during the Civil War, when demand for salt was high, but business slowed post-war and folded in 1865, leaving Flagler some $50,000 in debt.

To pay off this debt, Flagler reportedly moved his family again, this time to Cleveland, where he re-entered the grain business as a commission merchant. It was during this time that Flagler met fellow grain merchant John D. Rockefeller.

The Standard Oil Days

When Rockefeller left the grain industry to start an oil refinery in 1867, he called upon Flagler to join him. With a loan from a relative, Flagler became part of a triad of partners in the Rockefeller, Andrews and Flagler Oil Refinery (RAF Refinery), along with British chemist and inventor Samuel Andrews.

"The part played by one of my earliest partners, Mr. H.M. Flagler, was always an inspiration to me," Rockefeller said in his book *Random Reminiscences of Men and Events*. "He invariably wanted to go ahead and accomplish great projects of all kinds. He was always on the active side of every question and to his wonderful energy is due much of the rapid progress of the company in the early days."

In 1870, RAF emerged as a joint-stock corporation under the new name Standard Oil. Two years later, Standard Oil was leading the refinery industry, producing 10,000 barrels per day. In 1877, the company headquarters moved to New York City, and the Flaglers moved into a residence on 5th Avenue.

Within a year, Mary was diagnosed with tuberculosis. At the doctor's advice, Flagler took her to Jacksonville, Fla., for the winter to escape the cold. With Mary feeling stronger, and it being difficult for Flagler to manage Standard from so far away, the couple returned north to their 5th Avenue home. Mary's condition worsened in New York, and she died in 1881.

A Grand Vision for Florida

Not only had he lost his wife, but Flagler's business practices had become the subject of media and public scrutiny, with Flagler accused of calling in political favors to ward off competition. In 1882, he was called to testify before a Senate antitrust committee.

"Flagler had amassed a fortune … but at the same time his monumental business achievements had brought him the apparent enmity of an entire nation," writes author Les Standiford in *Last Train to Paradise*. "In addition, he had lost his [first] wife, the virtual supporting pillar of his private life.

"It should have come as no surprise then," Standiford observed, that Flagler "should be poised for a sea change."

In his personal life, Flagler didn't have to look far to find a new companion. He married one of Mary's nurses, Ida Alice Shourds, in 1883. Like Flagler, Ida Alice was also a minister's child, who grew up in poverty. Flagler was smitten with the woman, who is said to have had flaming red hair and a volatile temper, although friends and family disapproved of her lack of formal education and refinement. Upon marrying Flagler, Ida Alice became known for her fabled shopping sprees and one of the most elaborate wardrobes in New York City.

Flagler and his new bride traveled to St. Augustine for their December honeymoon. Finding the town charming, but the hotels and transportation inadequate, Flagler, the perennial entrepreneur, launched into his next venture: setting out to make Florida more accessible to tourists. In just a few years, Florida would become Flagler's empire and a playground for the rich.

After resigning himself from the day-to-day operations of Standard Oil, Flagler began construction of the luxurious Ponce de Leon Hotel in St. Augustine in 1885. The hotel was built in Gilded Age imitation of Spanish Renaissance style and was outfitted with Tiffany windows and chandeliers. Its grandeur attracted presidents including Grover Cleveland and William McKinley and millionaires like Rockefeller and George Pullman. With the 540-room establishment a success, Flagler built another hotel in St. Augustine, the Alcazar, and purchased a third, the Cordova. The hotels included luxuries unknown to Florida at this time, such as indoor pools, tennis courts, concert rooms, bowling, high-end shops, tropical gardens and more. Even Thomas Edison was said to be a frequent guest at the Alcazar, which boasted a casino.

In an 1887 interview with the Jacksonville *News Herald*, a reporter asked Flagler why a man with a major interest in what was arguably the most powerful company on earth, Standard Oil, would want to get into the hotel business – which could never provide such an income. Flagler told the reporter, "For the last 14 or 15 years I have devoted my time exclusively to business, and now I am pleasing myself."

That Flagler was to become a permanent fixture in Florida became official when he finally constructed a private residence there, called Kirkside.

Paving A Path

Flagler knew that if his hotels were to be successful, he needed to create an easy way for tourists to reach them. So, he turned his eyes to transportation, and first on his list of rapidly growing acquisitions was the Jacksonville, St. Augustine & Halifax Railroad, which he purchased in 1885, and would eventually become the Florida East Coast Railway. He also constructed a depot, churches, schools, utilities and neighborhoods for his workers.

Flagler next purchased the St. John's Railway, the St. Augustine and Palatka Railway, and the St. John's and Halifax River Railway. By 1889 "Flagler's System" offered service from Jacksonville to Daytona. He continued developing hotels to entice northern tourists.

Beginning in 1892, Flagler began laying new railroad tracks instead of purchasing existing railroads and merging them into his growing rail system. Expanding the railroad south to Palm Beach in 1894, Flagler then opened the Royal Poinciana and the Palm Beach Inn, which was later renamed The Breakers.

Palm Beach was to be the railroad's final stop, but during 1894 and 1895, severe freezes hit the area, prompting Flagler to consider southward. He was further persuaded by offers of land from private landowners, the Florida East Coast Canal and Transportation Co., and the Boston and Florida Atlantic Coast Land Co.

In September 1895, Flagler's system was incorporated as the Florida East Coast Railway Co. and by 1896, the railroad reached Biscayne Bay, where according to a Flagler Museum

Photo page 18: Flagler's mansion, Whitehall, is now the Henry Morrison Flagler Museum in Palm Beach. This page: Florida East Coast Railway's Henry M. Flagler train picks up passengers in the 1940s, top; one of Flagler's first hotels, the Ponce de Leon Hotel in St. Augustine, is now the home of Flagler College, bottom.

ALL PHOTOS COURTESY OF THE STATE ARCHIVES OF FLORIDA, FLORIDA MEMORY PROGRAM.

Henry Flagler's second hotel in St. Augustine, the Alcazar, played host to many famous guests and featured a casino.

biography, "Flagler dredged a channel, built streets, instituted the first water and power systems, and financed the town's first newspaper, the *Metropolis*." The biography goes on to say, "When the town incorporated in 1896, its citizens wanted to honor the man responsible for its growth by naming it 'Flagler.' He declined the honor, persuading them to use an old Indian name, 'Miami.'"

Pushing ever farther south, he bought three ships in 1899 to transport guests to and from the Bahamas, where he owned two more hotels. This involved dredging a channel through the Biscayne Bay so his ships could enter the Miami harbor.

Although his empire was growing, Flagler's personal life was in turmoil at the time as his wife, Ida Alice, became mentally ill. She was institutionalized in 1897 and declared legally insane in 1899. Flagler divorced her and married his third wife, Mary Lily Kenan, in 1901. As a wedding present, he built her Whitehall mansion in Palm Beach. The New York *Herald* described Whitehall as, "More wonderful than any palace in Europe, grander and more magnificent than any other private dwelling in the world ..." At 60,000 square feet, the 55 rooms of the lush Gilded Age mansion included guest suites, servants' quarters and private offices for Flagler and his secretary.

The Final Push South

Beginning in 1905, Flagler embarked on his greatest challenge yet, to build what would be called "Flagler's Folly," a seven-mile stretch of railroad over open water to Key West.

"It is perfectly simple," Flagler told Dr. Andrew Anderson, a friend and associate. "All you have to do is build one concrete arch and then another, and pretty soon you find yourself in Key West."

The endeavor came at a time of the building of the Panama Canal, and Flagler envisioned Key West's deep harbor as becoming the trade hub for vessels passing through it with his trains then providing deliveries up and down the East Coast. At one time, more than 3,000 men were employed to work on the project, which Flagler undertook with his own money, not a loan.

"With him it is never a case of 'How much will it cost?' Nor of 'Will it pay?'… Permanence appeals to him more than to any other man I have ever met," said writer Edwin Lefevre. "He often told me that he does not wish to keep on spending money for maintenance of way, but to build for all time."

Construction problems and hurricanes in 1906, 1909 and 1910 almost sunk the railway—literally. Hundreds of workers reportedly died in the 1906 storm. But in 1912, against all odds, Flagler's vision materialized with the opening of the Florida Overseas Railroad, and Flagler himself rode the first train into Key West in what was a belated 82nd birthday celebration.

He reportedly put his hand on the shoulder of Joseph Parrott, one of his advisers, and said, "Now I can die happy. My dream is fulfilled."

The next year, Flagler, 83, died in Palm Beach on May 20, 1913, following a fall down a flight of marble stairs at his Whitehall home. A black-draped train carried his remains back to St. Augustine, where hundreds reportedly gathered outside the Ponce de Leon to mourn him. Flagler was buried in the Memorial Presbyterian Church mausoleum with his first wife and daughter Carrie.

According to a report in the *St. Augustine Evening Record*: "The gloom inspired by the loss of Florida's foremost citizen was intensified by gathering clouds and the splashing of heavy raindrops, as if nature had joined in the general mourning, and was shedding tears. The silent crowds, with heads bared heeding not the falling rain, but followed the hearse as it moved slowly away on King Street, thence along Sevilla Street to Memorial Presbyterian Church, where the last sad rites were solemnized."

Flagler's last great accomplishment, the Florida Overseas Railroad, was destroyed on Labor Day 1935 by a hurricane, but the legacy of "the grandfather of Florida tourism" remains up and down Florida's east coast.

Flagler's name can be found on entities including Flagler County, Flagler Beach, Flagler Hospital and Flagler College (built on the site of the Ponce de Leon Hotel). There is a monument to him in Biscayne Bay, and the Flagler Museum in Palm Beach, at the Whitehall estate, is open to the public. One of Flagler's private railroad cars was restored to its original early 20th-century splendor and sits on the museum's grounds.

"Henry M. Flagler first built Standard Oil, then built the state of Florida. He may have been America's most modest industrial titan, and its most underappreciated," said writer John Steele Gordon in *Audacity Magazine*, 1996. "Henry Flagler was not only present at the creation of the modern economic world, but was one of its prime creators."

A Walk-On Coach Leads the Way

By Michael Josephson

Richmond High School near Oakland, California, is in the midst of poverty and violence. Many of its students don't take education very seriously and hope is in short supply. But in 1999, the school had one thing going for it: its winning-est basketball team ever. They were 13-0 when Coach Ken Carter made national news by benching his entire squad, locking them out of the gym, and forfeiting the next two games to emphasize his demand that his players take their studies seriously.

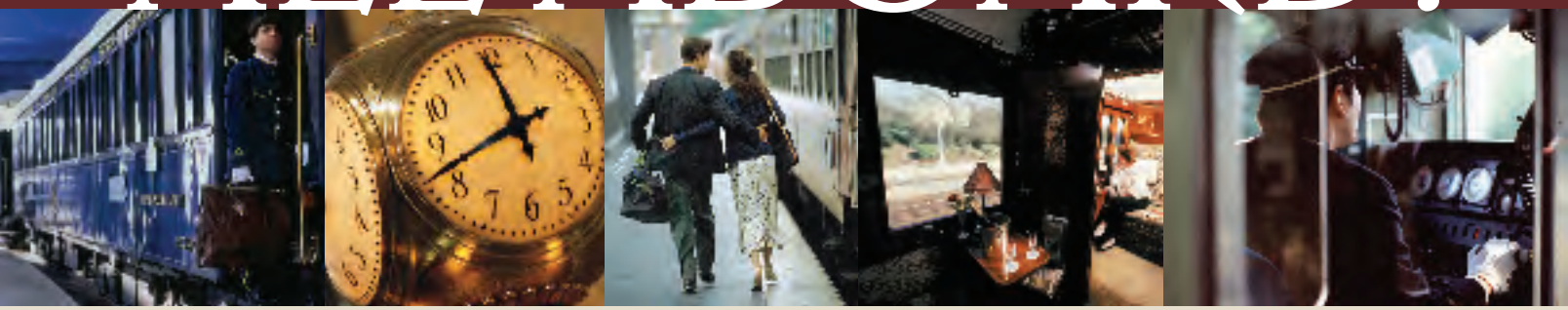
But that's not all. In a city plagued by gangs, he makes players sign and live up to an agreement requiring them to stay off the streets and maintain a 2.3 grade point average—higher than the state's minimum 2.0 GPA for sports participation. What's more, Carter's students not only must attend classes, but must sit in the front row.

The great thing is it all works. According to a July 2001 article in the *Los Angeles Times*, all 15 academic slackers on the 1999 team are going to college. This story is all the more remarkable since Carter isn't a full-time coach or even a member of the Richmond faculty. He's a walk-on coach who runs a sports supply store and a barbershop for a living.

But when he's with his team, Coach Carter knows he is, first and foremost, a teacher. Explaining his stance for academics, he said, "On the streets and public basketball courts in Richmond and any other city in America, you see the broken dreams of former high school legends who got left behind by life. And I'm not going to let that happen to these boys."

Carter's definition of winning seems to be getting a college education for his athletes. With this definition, maybe winning is everything.

ALL ABOARD!



Four great ways to see the world through the window of a train.

No sense denying it: There is a magic about trains. This magic can take hold early in life, and sometimes it never lets go.

Maybe it dates to all those childhood hours spent watching toy engines and boxcars chug around in circles on the basement floor. Maybe it comes through all the great songs we've heard over the years about lonesome whistles and trains a' comin'.

Maybe it's simple nostalgia here in the age of air travel, a longing for a time when we didn't have to take off our shoes here and latch our seat belts there.

STORY BY JIM DUFFY

Whatever the source, trains have a way of grabbing a special sort of hold in the imagination. The mere sound of one rolling in from the distance can stir something deep inside, a desire to climb aboard and see what adventures await out there on the rails.

That doesn't have to be a passing daydream. Great train journeys await in just about every corner of the world.

Here are snapshots of four of the grandest rail-travel opportunities to be found.


ALASKA
3009
3009
ALASKA
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CONTINENTAL EXTRAVAGANZA

When it comes to sheer luxury, no brand name in travel approaches the cache of the Orient Express. Oddly, though, the train's first-ever run on October 4, 1883, sounds like a rather arduous affair. The Express ran only from Paris to Vienna that day; a full rail connection with Istanbul wouldn't be available for another six years.

Instead, passengers were ferried across the Danube at Vienna and herded onto another train headed to the Bulgarian city of Varna, where they boarded yet another ferry to reach their final destination. But even such an inauspicious beginning didn't stop the Orient Express from becoming synonymous in the decades that followed with most all of the sumptuous things in life—fine cuisine, exquisite service, lush accommodations and lavish surroundings.

The Orient Express and other luxury rail lines in Europe date to the over-the-top railroad days of the 1920s and 1930s.

Alas, the original Express is no more; the train stopped running in the 1960s. Not to worry, though: The Venice Simplon-Orient Express is here to offer today's travelers a fair facsimile of the original experience. This Orient Express runs twice a week between London and Venice (with longer "premier journeys" sometimes offered to special destinations, including one to Istanbul in 2007).

The two-day, one-night trip to Venice begins in London's Victoria Station, aboard impeccably restored and appointed

ABOVE PHOTO COURTESY OF ORIENT-EXPRESS HOTELS, TRAINS & CRUISES.
PREVIOUS PAGE, PHOTO COURTESY OF ALASKA RAILROAD CORPORATION.

Photo page 23: Alaska Railroad's new double-deck dome cars pass breathtaking scenery. Page 24: The Venice Simplon-Orient Express passes through Lucerne, Switzerland. This page: a posh dining car on the Venice Simplon-Orient Express, left; unparalleled service on the Orient Express even comes to your door.

old Pullman cars bearing such timeless-sounding names as *Minerva, Perseus* and *Phoenix*. Once over the Thames, the first order of business is a three-course lunch, served in leisurely fashion while the train rolls through London's suburbs and into the English countryside. The food is the work of top French chefs. The service is the province of an Italian wait staff.

At Dover, a brief detour intrudes on the mood as passengers disembark for a regular coach shuttle through the Channel Tunnel. But once safely on the continent, it's back into the reassuring lap of luxury. The blue-and-gold carriages of the Compagnie Internationale des Wagons-lits et des Grands Express Europeens, the French company that created the Orient Express and other luxury rail lines in Europe, date to the over-the-top railroad days of the 1920s and 1930s. Unlike the Pullmans, these cars are known only by numbers, but each boasts its own design pedigree, detailed history and elaborate furnishings.

On the Orient Express, the job of passengers is to eat, drink, sleep, eat some more, socialize and then eat still some more, all the while admiring the views out the window. Everything else is best left to stewards, waiters—and the always reliable maitre d'.

With arrival in Paris comes a formal French dinner, followed by piano entertainments over nightcaps in the bar car. The next morning, breakfast arrives with a full view of the Alps. Morning tea is next, and lunch arrives soon after a brief stopover in Innsbruck. The descent into Italy offers some spectacular scenery, with Venice coming into view in the late afternoon.

***For detailed information about traveling through Europe aboard the Venice Simplon-Orient Express, visit* www.orient-express.com.**

ALASKAN VISTAS

Traced on a map, the Alaska Railroad looks like a bit of a letdown. The storied Denali Star line between Anchorage and Fairbanks covers just 356 miles, the tiniest sliver of the nation's largest state. Not to worry, though: Once this train starts rolling and leaves urban Anchorage behind, there's nothing small or modest about the vistas that soon come into view.

The country's tallest peak at 20,320 feet, distant Mount McKinley towers in the background as the train passes through sprawling wetlands, pristine pine forests and some amazingly rich farmland. (The growing season may be a scant three months here, but summer days deliver as many as 19 hours of crop-nourishing sunlight.) Don't forget to pack your binoculars, as the train slows frequently to let passengers properly admire the likes of moose, caribou and grizzly bears making their way in fields full of colorful wildflowers and lush blueberries.

Such scenery is the main reason more than half a million

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NEXT PAGE, PHOTO COURTESY OF ALASKA RAILROAD CORPORATION.

travelers sign on every year for this 12-hour excursion. Most do so during the summer season when the entire trip unfolds in those long daylight hours. Owned by the state, the Alaska Railroad has earned a reputation for taking special care of its tourist trade. In addition to a staff of professional guides, the Denali Star is chock-full of helpful high school students who've been through an intensive four-month training regimen on the state's natural and cultural history.

The first of the two main stops en route to Fairbanks is Talkeetna, a classic frontier village that serves today as a base station for the adventurous souls who dream of climbing McKinley (only about half of those who try actually make it to the summit). River safaris and raft trips are available at this stop. So is the Museum of Northern Adventure, which has memorable tales to tell of gold rushers, bush pilots, mountaineers and other adventurers.

Denali is the second stop. Here, a bevy of buses and tour companies will be waiting at the station to take passengers out to the spectacular Denali National Park and Preserve. At 6 million acres, the park is bigger than Massachusetts. It boasts an astonishing collection of wildlife amid sprawling tundras, glacial rivers and boreal forests. You can stay overnight at Denali, or linger for a week if you prefer, catching the train again at your convenience. No automobiles are allowed into the park's inner reaches; travelers make their way through the park aboard regular shuttle buses. Comprehensive bus tours also are available; a proper one will last anywhere from five to 13 hours.

Back aboard, the Denali Star covers the last leg of its journey to Fairbanks by traveling through several tunnels and then along the rocky ridges of the Nenana River Canyon, serving up breathtaking views of a river below that tends to flow wild and white. Coming into Fairbanks, the train passes over the Nenana along 702-foot-long Mears

Memorial Bridge, one of the world's longest single-span bridges. This is where President Warren G. Harding drove the golden spike that marked the completion of the construction of the railroad on July 15, 1923.

***For detailed information on traveling the Alaska Railroad, visit* www.akrr.com. *For information about visiting Alaska, visit* www.travelalaska.com.**

ACROSS VAST SIBERIA

Most of the world's great train trips are relatively convenient affairs, delivering levels of comfort in tune with our expectations of the modern world (and sometimes, as in the Orient Express, surpassing them). This is not the case with the Trans-Siberian Express between Moscow and Vladivostok.

For starters, this trip is uncommonly long—seven days, eight time zones and nearly 6,000 miles (not counting extensions into Mongolia and China). Then there's also the matter of scant creature comforts. Veterans of this trip report via the Internet a barrage of annoyances: iffy hot water supplies, sporadic housekeeping and dirty exterior windowpanes.

Then there's the food, which an online travel agency that has booked thousands of travelers on the line out of Beijing describes this way: "What you get in Russia has declined over the years ... So bring enough of your own instant whatever."

Intrepid travelers may well be able to shrug off such complications, however, and for them, the Trans-Siberian will be the trip of a lifetime.

This is the longest continuous rail line in the world, after all, extending more than one-third of the way around the globe while running through endless stretches of short-grass prairie (called "steppe" in Russia) and rich taiga forests. Construction of this railway began under Czar Alexander III in 1891, with convict work crews many thousands strong starting on opposite ends of the line and working toward the middle. The job took 14 years.

This is not a train geared to dawdling tourists. The two or three daily stops last less than half an hour each, barely enough time to run into a store for a few essentials. But opportunities for overnight stopovers abound. There's the millennium-old city of Yaroslavl, with its spectacular churches. Krasnoyarsk boasts fascinating gold-rush history and the nearby Stolby nature reserve.

Rail Reads

Don't bring beach reading onto the train. Try these rail-flavored tomes instead:

Murder on the Orient Express, by Agatha Christie
The Great Railway Bazaar and *The Old Patagonian Express*, by Paul Theroux
Nothing Like It in the World: The Men Who Built the Transcontinental Railroad, by Stephen E. Ambrose
Anna Karenina, by Leo Tolstoy
The Edge, by Dick Francis
The Great Train Robbery, by Michael Crichton

Photo, page 26: An Alaska Railroad train runs along the Placer River. This page: The Trans-Siberian Express.

Rail Extremities

These rail journeys offer travelers a glimpse of some genuinely world-class extremes, including:

- Alaska's Mount McKinley can make a case for itself as the world's tallest mountain. True, Everest rises to 29,000 feet above sea level (8,839 meters), but its base rests at 17,000 feet (5,181 meters). McKinley, by contrast, reaches its 20,000-foot peak (6,096 meters) from a starting point just 2,000 feet above sea level (609 meters). Do the math: McKinley's rise is 18,000 feet (5,486 meters), Everest's just 12,000 (3,657 meters).

- In Siberia, winter temperature can plummet below minus-90 degrees Fahrenheit (-68 Celsius).

- Travelers on the Venice Simplon-Orient Express pass through two of the world's longest tunnels. At 31 miles (50 kilometers), the Channel Tunnel between England and France ranks second. At 12 miles (19 kilometers), the Simplon Tunnel in the Alps ranks fifth. (The other three members of the top five are in Japan.)

- Except for railroad-less Antarctica, Australia is the world's driest continent. Parts of the desert outback that The Ghan traverses get just four inches of rain a year.

In Irkutsk, the Trans-Siberian skirts the shores of gorgeous Lake Baikal, the world's deepest body of fresh water. Siberian Ulan Ude is the center of Buddhist culture in Russia, home to a famous restored monastery called Ivolginsk Datsan. At the end of the line lies Vladivostok, a maritime city built around a spectacular harbor on the Pacific Ocean. It offers connections to whole new worlds of adventure: a ferry line to Japan, for instance, or a climb back aboard the train, this time headed down into China.

There is no one Web site or phone number that delivers reliable and comprehensive information about traveling the Trans-Siberian. The best way to plan such a journey is through a travel agent with extensive experience in booking tickets and making arrangements in Russia.

HEADING INTO THE OUTBACK

One of the newest of the world's great train adventures awaits Down Under. Railroad buffs there endured the better part of a century salivating with anticipation over a long-planned north-south run across the Australian continent.

The first leg of the journey was completed all the way back in 1929, but it wasn't until 2004 that "The Ghan" finally began making its regular run from southern Adelaide to northern Darwin.

The two-day journey covers nearly 2,000 miles and boasts some of the world's most remote and astounding natural scenery. In some stretches, the view from the train window will seem quite forbidding — The Ghan takes its name from the Afghan camel trains that in the 1800s offered the only means of transport through the vast Australian desert. In other stretches, the view will be majestic — rivers in the remote Northern Territories run through rock-lined canyons on the scale of the American Grand Canyon.

With two locomotives and about 40 carriages, The Ghan stretches more than half a mile along the rails. It offers the usual array of accommodations, from the scrunched-in-your-seat basics all the way up to the Prince of Wales private carriage, which sleeps 10 and has its own private lounge.

Railroad travel Down Under has come a long way since the making of the popular old legends about trains stranded so long by flash floods that conductors had to venture out on hunting expeditions to feed the passengers.

The Ghan makes two main sightseeing stops. The first is at Katherine Gorge, a seven-mile stretch of deep orange canyon lined by steep cliffs rising more than 200 feet above the Katherine River. Here, Ghan passengers can sign on for canoe trips, boat cruises and helicopter flyovers.

ABOVE PHOTO COURTESY OF THE GREAT SOUTHERN RAILWAY.

Photo, page 28: The Ghan crosses the Ferguson River. This page: Local residents welcome The Ghan to the town of Katherine, top; private lounge in The Gahn's Prince of Wales carriage.

The other is the city of Alice Springs. Nearby Desert Park showcases the environment of the famed Australian outback and explores the culture of the continent's aborigines. City tours, park tours, automated no-pedal bicycle rides and helicopter flyovers are all available here.

Urban Darwin is The Ghan's final destination. When the train arrived here on its maiden trip two years ago, a group of 60 fun-loving locals greeted it with a perfectly choreographed stunt, all bending over in unison to moon The Ghan and its passengers. Obviously, Australians can be a quirky and unpredictable bunch.

If you don't get enough of a taste of the country while aboard The Ghan, don't worry. You can sign on for a trip aboard the Indian Pacific, the train line that runs east-west across the continent between Sydney and Perth.

***For information on traveling The Ghan, visit* www.gsr.com.au. *For information about visiting Australia, see* www.australia.com.**

RIGHT PHOTO COURTESY OF THE GREAT SOUTHERN RAILWAY.

Locomotive Safety Means Using the Right Product

By Phil Kimble

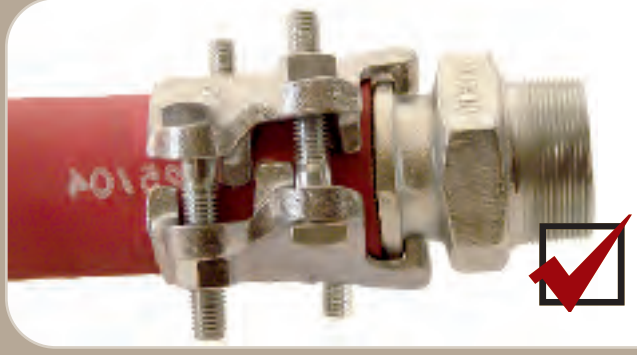
Locomotive. Iron Horse. Train. In the 1800s, trains played a key role in transporting workers, entrepreneurs and adventurers to the western frontier. Trains also fed the West's voracious appetite for building materials, agricultural and industrial equipment, and various supplies. America was infatuated with trains. Today, when almost everyone has a car, jet planes fly coast to coast in a matter of hours and 18-wheelers roar along every highway, trains have faded into obscurity.

Or have they? Trains are the unsung heroes of American industry. Trains still convey vast quantities of product over huge distances to all parts of the country. Approximately 42 percent of U.S. freight moves quickly and efficiently by train.

One of the products routinely transported via train is coal tar pitch. Coal tar pitch has a wide variety of uses, including as roofing materials, pipe coatings and antifouling paints for boats. Coal tar pitch is usually heated to about 350 degrees Fahrenheit for efficient loading and unloading. Typically, a hose with cam and groove couplings connects a pump to a tank car. The hot liquid is then pumped into the tank car.

One coal tar pitch loading facility implemented, as one of its standard operating procedures, the practice of using a piece of wire to tie down the handles of the cam and groove coupler connecting the hose to the tank car. This was done to prevent the cam

BOSS STYLE CLAMPS - DO AND DON'T

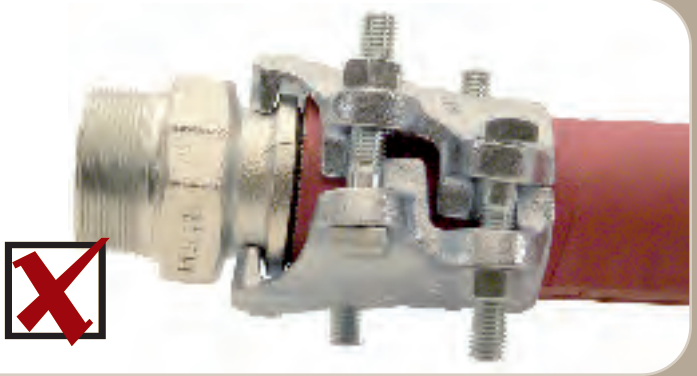


DO:

- Select the proper clamp based on inside and outside diameter of hose.
- Ensure even showing of hose between the clamp sections.
- Tighten bolts to recommended torque.
- Know that clamps are designed to bend.
- Re-torque bolts regularly.

DON'T:

- Allow the individual body sections of the clamp to touch.
- Reuse bolts.
- Replace bolts with bolts of any other strength.
- Reuse clamps.



arms from opening while loading. New employees were instructed, in addition to use of proper safety gear, to attach the coupler to the adapter on the tank car, then insert a wire through the rings on the cam arms, twist the wire until the cam arms were secured in the closed position, and then start the pump.

One new employee began the loading process by connecting the hose to the tank car and then starting the pump. While waiting for the tank to load, the cam arms on the coupler opened up, the hose whipped around, sprayed him with hot coal tar pitch, and then knocked him off the loading platform. The fall broke both of his legs. The hot coal tar pitch left him with second- and third-degree burns on over 80 percent of his legs and torso, even with his safety apparel on.

Positive displacement pumps, such as diaphragm and piston, create pulsations in a line. These pulsations cause the cam arms in standard cam and groove couplers to rock back and forth on the adapter groove. This rocking motion can ultimately lead to the cam arms rotating to the open position and the coupler separating from the adapter. Even if a procedure has been implemented into a company policy, it may be flawed. That flaw may have catastrophic consequences. This tragic accident could have easily been prevented. Hazardous applications require superior products. King Cables prevent hoses from whipping in the event of an accidental disconnection. EZ Boss Lock couplers have handles that lock automatically in the closed position. No wire ties. No Velcro straps. No cumbersome pins. "The Right Connection."

Swimming For Fitness

By Sue De Pasquale

Would you like to find a single activity that can improve your aerobic fitness, boost your body strength, increase your flexibility and tone your muscles? Look no farther than your local swimming pool. Considered the perfect form of exercise by many fitness experts, swimming is truly a lifetime activity—something you can pursue well into your 80s or 90s—that almost completely avoids wear and tear on muscles and joints.

"The feel of the water, the weightlessness; it's so relaxing to be in such a different environment, with such buoyancy," says Annie Lawler, veteran swimming instructor at the North Baltimore Swim School at Meadowbrook, the facility where six-time Olympic gold medalist Michael Phelps trained.

While there are plenty of older folks who rely on water activities to relieve their arthritis, Lawler also sees her share of middle-aged and younger athletes—competitive runners, cyclists, tennis players—who head to the pool on the advice of their doctors.

Gail Owen, for example, was an avid tennis and squash player well into her 30s, until, she says laughingly, "my body parts started wearing out." After surgeries on her foot and knee, she turned to swimming to stay fit. "Swimming keeps the body toned but it doesn't hurt you. I love everything about it," she says. Now 60, Owen swims three times a week at Meadowbrook. "It refreshes me and keeps me relaxed," she says. "I try to enjoy each swim and I usually do."

Before starting your own fitness program, Lawler suggests signing up for a stroke clinic or swim class for a refresher in technique. "We now know how to swim with a lot more ease than in the old days," she says. If classes aren't your thing, there are plenty of good books out there. Lawler's personal favorite: *Fitness Swimming* (Human Kinetics Publishers, 1998) by Emmett Hines. (To find swimming facilities in your area, visit the Web site of United States Masters Swimming, a national organization that promotes swimming for fitness and competition, at www.usms.org.)

Proper breathing is the biggest challenge for many novice swimmers. That's because the process (inhale through the mouth; exhale through the nose) is the opposite of what runners and other "land" athletes are used to doing, Lawler says. Being relaxed is key. The looser you are, the more air you can take in with each breath.

Once you're ready to take the plunge, Lawler offers these tips:

- Aim to swim at least three times a week, starting with 30-minute workouts and building up to 45 minutes or an hour. (Be sure to bring a water bottle to the poolside—staying hydrated is vital!)

- Don't get discouraged! The goal is to increase distance and decrease rest time over a period of weeks. Start by resting for 30 seconds or a minute between each lap, then reduce the rest to 15 seconds, then five seconds, until you are swimming continuously.

- Mix it up! Doing a variety of strokes at different speeds will keep your workout interesting, help prevent injury and ensure you work different muscle sets. (The breaststroke works the inner and outer thigh, for instance, while the butterfly is great for the abs.) Water aids such as kickboards and fins (which strengthen and tone leg muscles) can also be a great addition to your workout.

- Be social: Enjoy meeting up with your fellow swimmers in the locker room and chatting at the end of the lap lane. And augment lap swimming with a class in aqua running or water aerobics. Having your head out of the water allows you more time for camaraderie.

- Warm up/warm down: Just as with other activities, you should start your workout at a warm-up pace, move into your main set, then cool down before finishing. While some prefer to loosen up with a soak in the hot tub before swimming, others make it their last stop before hitting the showers.

What you'll need to get started

The "supply" list for swimming is refreshingly simple.

WATER BOTTLE: Though surrounded by water, you still sweat when you swim, and blow off water vapor as you breathe. Keep a supply of water at poolside and drink regularly (before you get thirsty) throughout your workout.

SWIMSUIT: A snug fit is key when choosing a "competitive" swimsuit — the kind usually made of Lycra and meant for swimming laps rather than lounging beachside. Many suits will stretch a full size after just a few swimming sessions, and that means added fabric flapping around and slowing you down. Annie Lawler, veteran swimming instructor at the North Baltimore Swim School at Meadowbrook, advises men to "summon up the courage" to wear a pair of form-fitting racing briefs. "Trunks are nothing but drag," she notes.

GOGGLES: Key to protecting your eyes from the sting of prolonged exposure to chlorine, these come in different shapes equipped with different gaskets (the soft material around the eyecup). To find the style that best fits the contours of your face, try on a variety.

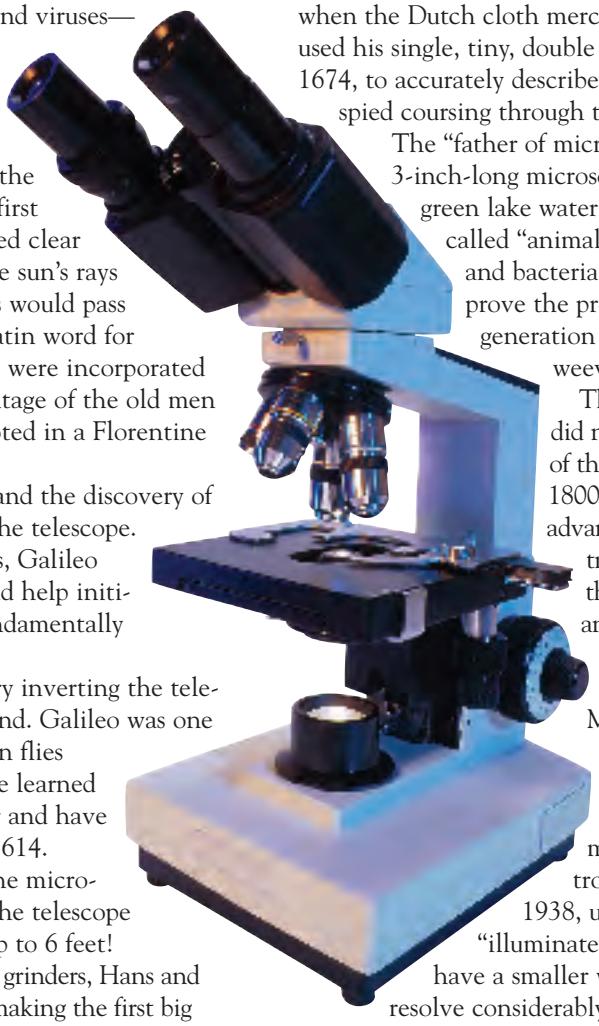
CAP: Vital for keeping hair out of your eyes, nose and mouth, a swim cap also helps minimize water resistance.

The Microscope

Its invention opened windows into unknown worlds.

BY SUE DEPASQUALE

Unlike any other invention, the microscope has unveiled the very building blocks of life. Peering into the mysterious world of the microcosmos, scientists over the centuries have gained a window on the previously unfathomable—cellular processes, the workings of bacteria and viruses—making possible the major advances in biology and medicine that we take for granted today.



While it's impossible to say for sure who invented the microscope, the concept behind it goes back to the first century A.D., when the Romans used clear pieces of "burning glass" to focus the sun's rays and start fires. Hundreds more years would pass before "lenses" (derived from the Latin word for lentil, whose shape they resembled) were incorporated into spectacles, "for the great advantage of the old men when their sight grows weak," as noted in a Florentine manuscript of 1299.

Fast forward to the 16th century and the discovery of that great astronomical invention, the telescope. Gazing out upon the moon and stars, Galileo Galilei made observations that would help initiate the scientific revolution that fundamentally changed our world.

It didn't take long for people to try inverting the telescope to enlarge objects closer at hand. Galileo was one of them. "With this tube, I have seen flies which look as big as lambs, and have learned that they are covered over with hair and have very pointed nails," he reported in 1614. Because these early forerunners of the microscope were based on the reverse of the telescope they were heavy and very long — up to 6 feet!

The Dutch father/son team of lens grinders, Hans and Zacharias Janssen, are credited with making the first big advance on the simple microscope by combining two lenses—the "ocular" near the eye, and the "objective" near the sample.

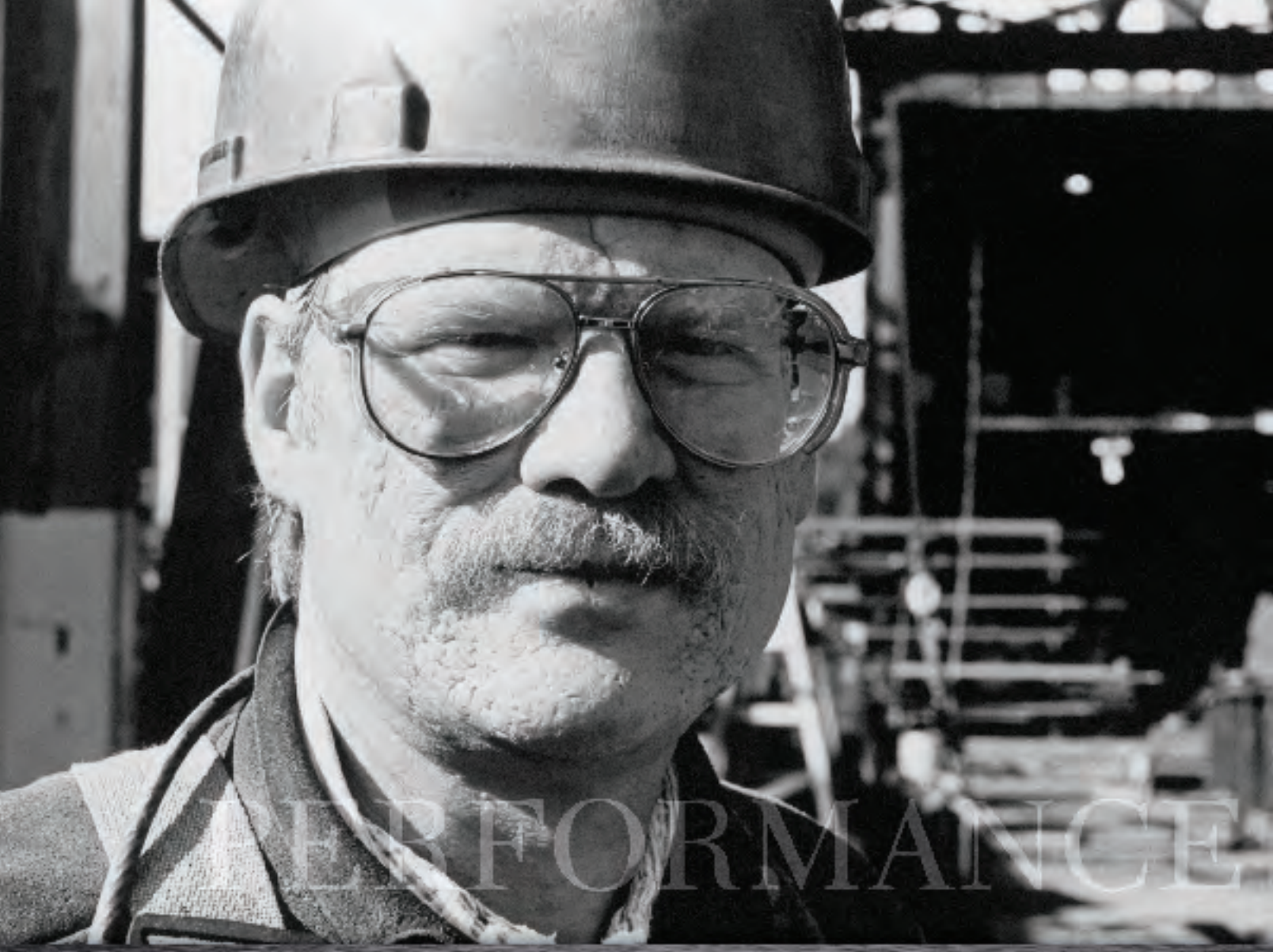
The age of experimentation had arrived and the time was ripe for Englishman Robert Hooke and his engaging *Micrographia*, published in 1665. In a series of 57 dramatic illustrations, Hooke made visible for the first time the anatomy of a flea, the eye of a fly, the structure of feathers. To describe the honeycomb pores of cork, he coined the term "cells" (named for the tiny monastery rooms they reminded him of). Hooke's drawings would remain the standard in scientific textbooks well into the 1800s.

Next came some of the first big advances in biology, when the Dutch cloth merchant Anton van Leeuwenhoek used his single, tiny, double convex lens microscope, in 1674, to accurately describe red blood corpuscles, which he spied coursing through the capillaries of a rabbit's ear. The "father of microscopy" would go on to use his 3-inch-long microscope to peer into a vial of cloudy green lake water to observe and describe what he called "animalcules" (known today as protozoa and bacteria). And he would help to disprove the prevalent theory of spontaneous generation when he observed fleas and weevils develop from tiny eggs.

The next observations of bacteria did not come until the improvements of the compound microscope in the 1800s. Among the most important advances: In the United States, country doctor Robert Koch discovered the bacilli that caused tuberculosis and cholera, two of the major killers of his time; the findings earned him a Nobel Prize in Medicine in 1905.

Today, advances in technology have made possible new microscopes with incredible magnification power. The electron microscope, first developed in 1938, uses electrons rather than light to "illuminate" an object. Since electrons have a smaller wavelength than light, they can resolve considerably smaller structures, making it possible for the transmission electron microscope, for example, to magnify objects up to 1 million times. And the scanning tunneling microscope, developed in 1981 by scientists Gerd Binnig and Heinrich Rohrer, now gives researchers 3-D images of objects down to the level of a single atom.

By illuminating everything from cell division to the function of nerve cells, today's advanced microscopes continue to unlock nature's secrets.



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