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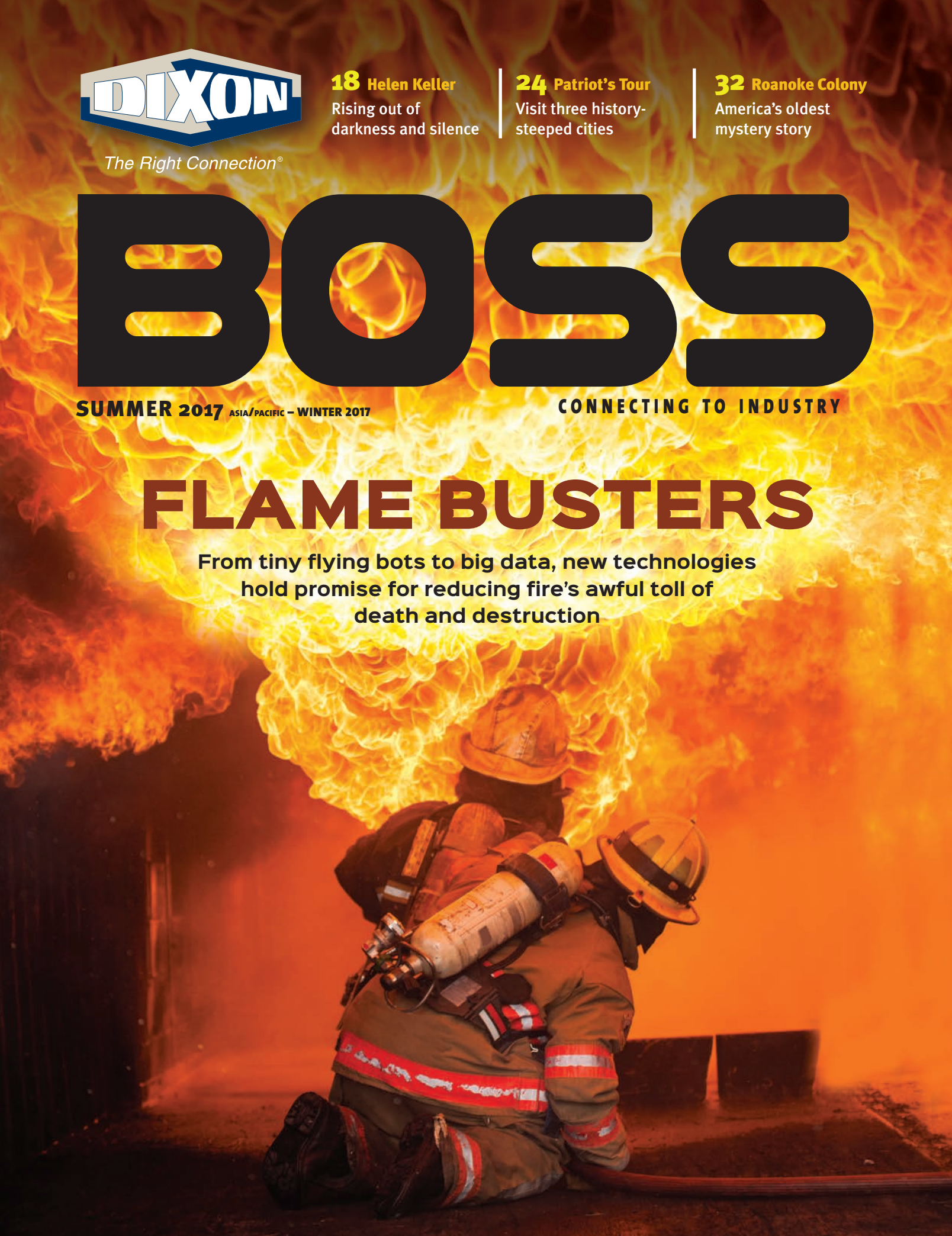
SUMMER 2017 ASIA/PACIFIC – WINTER 2017

CONNECTING TO INDUSTRY

FLAME BUSTERS

From tiny flying bots to big data, new technologies hold promise for reducing fire's awful toll of death and destruction



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COMMUNICATION IS KEY

When Alexander Graham Bell invented the telephone in 1876 (see page 40), he not only transformed the way we communicate with one another—he also changed the way we do business.

Before the advent of the phone, customers who wanted to place an order would do so by visiting in person, or by sending an order by mail or telegram. When I first started working at Dixon in the 1970s, and well into the 1980s, we were still receiving large stacks of paper orders each day in the mail. Today, less than 1 percent of our orders arrive that way.

That is because over the decades, our customers have transitioned to using new technologies that the telephone helped pave the way for: first telex, then fax, then electronic data interchange (EDI), and more recently email and the web. Our clients may still phone in their orders (and about 15 percent continue to do so), but most prefer to use the other options—thanks to new systems built on robust software designed to enhance and streamline the customer experience.

For any business, keeping pace with constantly changing technologies can be costly and time-consuming. But to remain successful today, it is vital for us to do so.

Thanks for reading,

Dick Goodall

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ON THE COVER
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The True Meaning of Our Lives

> I SAW A CARTOON of an old king checking in at the gates of heaven. The gatekeeper, with a large book in front of him, said, "Edward the Good, huh? Well, Eddie, we will be the judge of that." The point is that, in the end, generous self-appraisals won't matter. Our epitaphs will be written and eulogies delivered by the people who knew how we lived. The real meaning of our lives may be defined by how we are remembered.

When a Swedish newspaper printed Alfred Nobel's obituary by mistake, he had the rare opportunity to see how others saw him. It changed his life dramatically. Though the article was complimentary, describing Mr. Nobel as a brilliant chemist who made a great fortune as the inventor of dynamite, he was horrified to be memorialized in such materialistic terms. Determined to leave a more positive legacy, he bequeathed his considerable wealth to the establishment of the Nobel Prizes to acknowledge great human achievements. Few of us can create something as momentous as the Nobel Prizes, but we can all live lives that earn a eulogy our children and parents would be proud of.

In the hurly-burly of everyday living it's hard to keep perspective. Money, position, pride and power seem so important—until they're not. At the end of their lives, no one says, "I wish I spent more time at the office." It's a matter of priorities.

So if you want to know how to live your life, just think about what you want people to say about you after you die and live backwards. ✒

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Father of Immunology

Edward Jenner developed the vaccine that ultimately vanquished smallpox

World History Archive /Newscom

Edward Jenner vaccinating a child against smallpox using cowpox serum. Artist's impression from *Le Petit Journal*, Paris, 1901.

> ON MAY 8, 1980, the World Health Assembly issued a remarkable statement. The world, at last, was free of smallpox—a disease that had decimated populations and caused terror for more than 10,000 years.

Much of the credit for this momentous accomplishment goes to Edward Jenner, an 18th-century country doctor from England who developed the smallpox vaccine. Jenner was the first to take a scientific approach to vaccination and the first to develop an attenuated, or live, vaccine—the kind now used to keep measles, mumps and tuberculosis at bay. Dubbed the "father of immunology," Jenner is credited with saving millions of lives.

And it all began with a dairymaid's comment, overheard by Jenner when he was just 13.

The eighth of nine children, Edward Jenner was born in Gloucestershire, England, on May 17, 1749, to Rev. Stephen Jenner, the vicar of Berkeley, and wife Sarah. Sadly, Edward was orphaned at age 5 and so was raised by an older brother.

Early on, young Edward showed an interest in science and nature. At 13, he began working as an apprentice to a country surgeon, George Hardwicke.

Visiting a dairy farm with the doctor one day, Jenner heard a milkmaid say she was safe from smallpox and "would never have an ugly pockmarked face" because she had already had cowpox, a mild viral infection that sometimes spread from cows to the dairymaids who milk them. After getting cowpox, the dairymaids would feel a bit under the weather for a few days and get a few small pocks on their hands. Then they would recover—and they'd never get the dreaded smallpox.

It's difficult to overstate just how awful smallpox was for people living at this time. The "speckled monster," as it was known, had a fatality rate as high as 60 percent in adults and 80 percent in infants. In 18th-century Europe, it claimed an estimated 400,000 victims per year. Survivors often were blinded or disfigured by the disease's telltale lesions.

Jenner made a mental note of this conversation with the milkmaid. Then he went on to complete his medical training and pursue a medical career at St. George's Hospital in London. During these years he married Catherine Kingscote, started a family (the couple would have four children) and continued his wide-ranging research. He completed a seminal study on bird behavior, for instance, and developed a better method for preparing a medication used to induce vomiting.

But Jenner's interest in smallpox never waned. Scientists had long known that survivors of smallpox were immune to the disease. To slow its spread, doctors practiced inoculation, or variolation: They inserted pus from a smallpox lesion under the skin of people who had never had it. Jenner himself had received this variolation

when he was a boy. While this practice proved effective for many, it also killed between 2 and 3 percent of the people who received it.

Jenner was determined to find a better solution. On May 14, 1796, Jenner performed the bold and now-famous experiment that changed the trajectory of history. He drew pus from the cowpox lesion of a dairymaid named Sarah Nelms, and infected 8-year-old James Phipps, the son of his gardener, through two small cuts in the boy's arm.

Young James felt ill for a few days. He ran a slight fever and lost his appetite. But he soon recovered. Two months later, to confirm whether the boy was now sufficiently protected against smallpox, Jenner repeated the procedure with matter from a smallpox lesion. James had no side effects, and Jenner announced that the boy had been successfully vaccinated against the deadly virus.

Jenner wrote a paper about his experiment, but the Royal Society rejected it in 1797. The following year, Jenner published his own booklet, in which he called his procedure *vaccination* (the Latin word for cow is *vacca* and cowpox is *vaccinia*).

Jenner spent much of the rest of his life promoting the cause of vaccination. He added a one-room hut to his property (the "Temple of Vaccinia") where he vaccinated the poor for free, and he shared the vaccine with scientists who brought vaccination to the United States and other parts of the world. Though he received many honors for his breakthrough, he never profited from it. Jenner died on Jan. 26, 1823, from a massive stroke at the age of 73.

Vaccination against smallpox became compulsory in England and Wales in 1853, and in 1967, the World Health Organization launched a global vaccination campaign. Just 13 years later, the WHO announced, "The world and all its people have won freedom from smallpox."

To date, smallpox is the only infectious disease that humans have vanquished.

FLAME BUSTERS

From tiny flying bots to big data, new technologies hold promise for reducing fire's awful toll of death and destruction

BY ALLEN ABEL

"fire helment icon" AlonzoDesign/DigitalVision Vectors; "building" borchee/E+/Getty Images; "large burn" d1sk/iStock/Getty Images Plus/Getty Images; "burn holes throughout" macrovector/iStock/Getty Images Plus/Getty Images

When the residents of the tiny town of Bar Nunn, Wyoming, saw a cyclone of smoke barreling down Palomino Avenue toward their houses in July 2015, they were gripped by the same terror that has stricken human beings for thousands of generations: the fear of fire.

It was a Monday afternoon on a scorching summer day. Hundreds of acres of Natrona County grassland already had burned when the fiery gale turned toward town. Firefighters went from door to door, alerting dozens of families that they might need to evacuate their homes within minutes.

"I was the first on scene and all by myself," remembers Rusty Dunham, then-chief of the Bar Nunn Volunteer Fire Department. "I was in the truck trying to catch up with the fire. We were just getting a handle on it when the wind direction changed from 30 mph from the south to 70 mph from the west. That's what caught us off-guard."

Ten years earlier, Dunham had watched two Wyoming firefighters lose their lives in the collapse of a local townhouse. "They were looking for kids who weren't even in the structure," Dunham says.

In the 21st century, even in the wealthiest and most technologically advanced of nations, fire kills.

- At the ramshackle Ghost Ship concert venue in Oakland, California, in 2016: 36 dead.
- At a Christmas party in the Chinese city of Luoyang, in 2000: 309 dead.
- In Portugal in 2003, on the hottest day in at least two centuries: 18 dead in wildland fires whipped by a sirocco (oppressively warm) wind.
- In the mountains of Arizona in 2013, at a place called Yarnell Hill, in a fire started by lightning: 19 firefighters from the Granite Mountain Hotshots team burned to death in their portable shelters.


Comstock/Stockbyte/Getty Images

Every year, remorseless and unpredictable, fire takes the lives not only of tens of thousands of citizens of every country on Earth, but also hundreds of men and women who have made it their life's work to defeat it.

But now—2,000 years after the first organized *vigiles* rushed with buckets of water to the blazes of Imperial Rome—new technologies are helping to reduce that awful toll.

These innovations include pilotless helicopters and smaller drone aircraft that monitor structural and wild land fires; autonomous vehicles that can put large quantities of water on a fire in conditions that no human could tolerate; powerful hoses that eject a fire-starving mist of microscopic drops of water; and real-time GPS, visual-spectrum and infrared displays that appear on a firefighter's face shield to guide him or her through the smoke and confusion of a major blaze.

Still to come—perhaps within this decade—are humanoid robots that can deploy hoses in the confined quarters of a flaming house or ship; tiny flying bots that can seek out unconscious victims on the upper stories of a burning home; and pilot-less aircraft capable of dousing a remote forest with buckets of water and retardants, even at midnight, eliminating the need for "hotshot" crews to penetrate the darkness.

Douglas R. Clifford/ZUMApress/News.com

Above left: Before a training exercise using a new self-contained breathing apparatus, a training chief synchronizes a firefighter's incident control module with the district chief's computer—allowing remote monitoring of temperatures inside structures and heart and oxygen rates of firefighters, in addition to remote signaling used to recall firefighters. Above right: Through the Congressional Fire Training program, Congressional staffers are put through exercises that firemen in training would encounter, including use of a thermal imaging device.

Evolving Advances

The quest for better tools to fight fires, and protect firefighters, is not new.

Just ask Ken Willette, segment director for the National Fire Protection Association in Quincy, Massachusetts. He started as a structural firefighter in 1974 and retired as a fire chief in 2009.

"Within that span of time I saw an evolution in the fire service," he says. "And one of the biggest evolutions was the impact of research that had been done for NASA in developing fabrics that could give firefighters protection against flame exposure. This allowed them to get closer to the fire, to contain the fire sooner, and to rescue civilians."

Willette has also witnessed improvements in firefighters' self-contained breathing apparatus (SCBA). "Better harnesses, lighter-weight gear, systems that allow firefighters outside the building to attack the fire—the impact of that technology has been huge," he says.

"More recently, we have been able to use thermal imaging cameras so that firefighters can see the room they're in translated into layers of temperature. Those cameras also have the ability to penetrate smoke to determine if there is a person overcome by smoke lying on the floor." When these cameras came out 20 years ago, he says, the cost was $15,000 to $20,000, making them prohibitively expensive for many fire departments. "Today," he says, "they are less than $1,000 because the technology has advanced so quickly."

Similarly, it's not unusual to see firefighting teams today arrive at the scene of a fire with an iPad in hand. "We can provide information to the incident commander about the layout of the building and the contents that are stored in the building," says Willette. Computers also allow firefighters to be tracked, conveying

NOTEWORTHY EVENTS IN EARLY FIREFIGHTING HISTORY

Ca. 230 B.C.

Ctesibius of Alexandria invents a pump that can siphon water from a pond or tank and direct it at a fire as a forceful stream.

6 A.D.

Augustus, Emperor of Rome, levies a 4 percent tax on slaves and uses it to finance cohorts of 70 to 80 men (known as *vigiles*) who are each equipped with a horse-drawn water tank and pump.

1672

Artist/scientist Jan van der Heyden of Holland designs a fire hose composed of 50-foot lengths of stitched leather.

1681

Just 15 years after the Great Fire of London, 12 men, led by Nicholas Barbon, establish the first "Insurance Office for Houses."

1723

English chemist Ambrose Godfrey patents a fire extinguisher that uses a cylinder of gunpowder to blow out fires.


Douglas Graham/Roll Call Photos/Newscom

Casey Grant predicts that computer technology—specifically big data—will be crucial to future advances in firefighting.

CALLS BY THE NUMBERS:

Statistics from one busy volunteer fire company, in Chestertown, Md., where Dixon Valve and Coupling is based.

2017 YTD: 174
2016 TOTAL: 593
2015 TOTAL: 505
2014 TOTAL: 728

For more information, go to chestertownvfc.org.

information to specialists who are not on the scene, who might know about the hazards awaiting them, he says.

As lead author of the "Road Map to Smart Firefighting," commissioned by the National Fire Protection Association, Casey Grant predicts that computer technology—specifically big data—will be crucial to future advances in firefighting.

"Take the case of a vehicle fire out on a highway. That's a relatively straightforward event," says Grant. "But when we arrive on scene, there are still a lot of things that we don't know. Is the fire electrical? What is this thing that is burning? Are there combustible metals involved? The black boxes that are in vehicles today have incredible information that is not being accessed by emergency responders. We want to get that data in their hands at every fire event by making our entire built infrastructure come alive with innovations.

"Data is the new oil," says Grant, "and the internet of things is a big part of it. For example, if you put a chip in the elbow of a pipe, it tells you when it's leaking. With this technology, you can follow the lifecycle of everything in a home or in a factory so that when firefighters show up at a fire scene, [ideally] they would have access to all that information."

Water, Water Everywhere

One of the most fascinating innovations in 21st-century firefighting involves repackaging water in a different form. "Watermist," a technology widely used in Europe for more than 20 years, is beginning to gain popularity in North America, says Hal Spencer, a retired wildland and structural firefighter in Boise, Idaho, and former fire chief of the structural fire program of the U.S.

1736

Newspaper publisher Benjamin Franklin helps to organize Philadelphia's Union Fire Company, a mutual-assistance brigade; each member is required to buy seven leather buckets.

1813

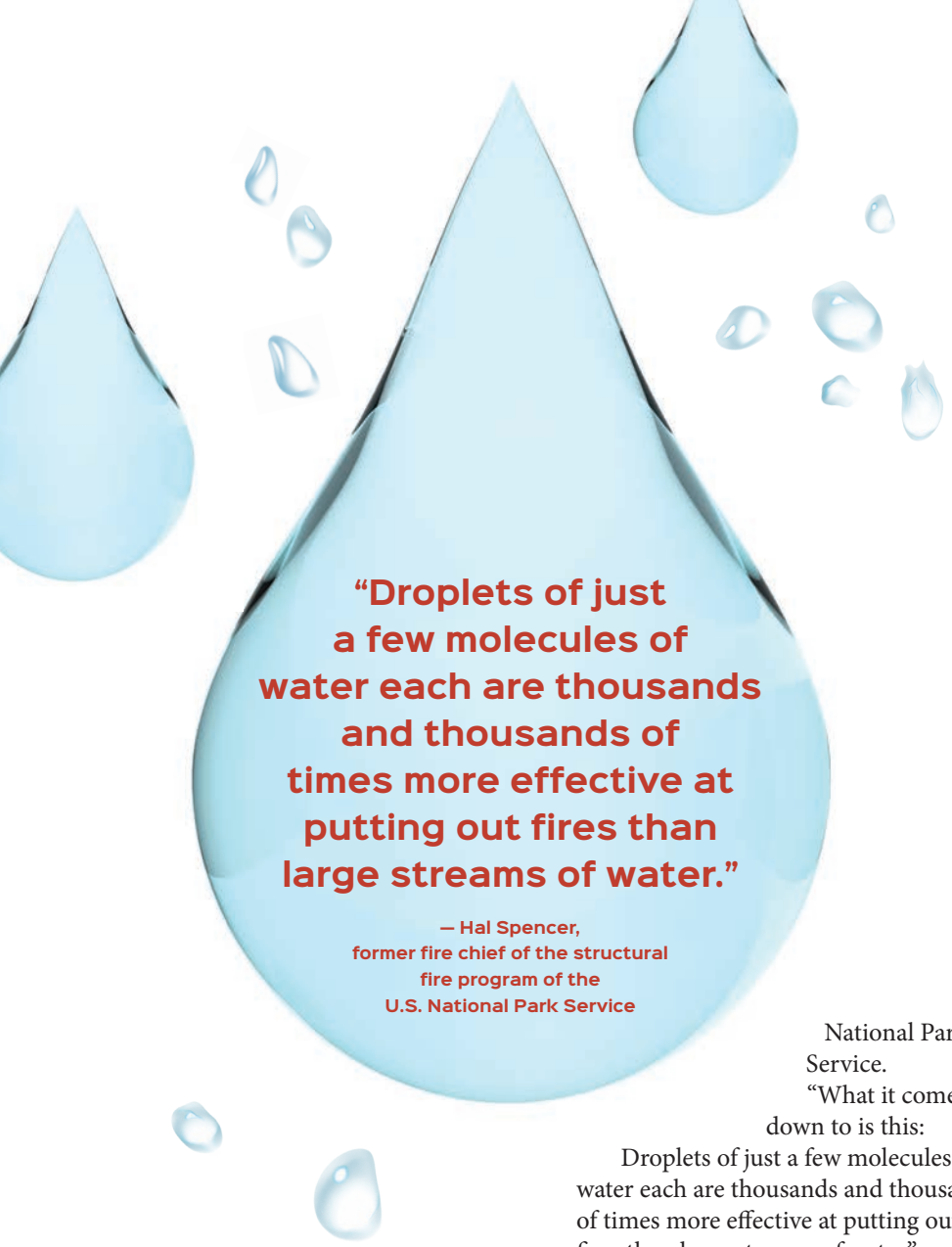
Wealthy Englishman George William Manby invents the first modern pressurized extinguisher, a copper cylinder filled with potassium carbonate and compressed air.

1852

Two Bostonians patent the first street-corner "Electromagnetic Fire Alarm Telegraph for Cities."

1874

Henry Parmalee, a Connecticut piano maker, invents the first automatic indoor sprinkler system, using solder to seal holes in water pipes laid across the ceiling, which melted during a fire to unplug the holes and release water.



"Droplets of just a few molecules of water each are thousands and thousands of times more effective at putting out fires than large streams of water."

— Hal Spencer, former fire chief of the structural fire program of the U.S. National Park Service

National Park Service.

"What it comes down to is this: Droplets of just a few molecules of water each are thousands and thousands of times more effective at putting out fires than large streams of water."

He goes on to explain: "If we kick open the door to a house, what do we introduce? Oxygen. And that's what kills firefighters. All the superheated gases at the top of those rooms flash over and that room just ignites to temperatures of 1,200 to 1,500 degrees Fahrenheit and it's instantaneous. The key is to lower the temperatures in the *building* before you even go inside," Spencer says.

With mist, firefighters drill a hole in the wall and thrust a mist-spraying lance in, then deliver the mist. "The aim is to maximize the surface area that is exposed to humidity—you fill up a room that's on fire with water that turns to steam and that knocks the fire down," he says. Not only does the steam suffocate the fire, but this system also greatly reduces water damage caused by traditional sprinkler systems.

Send in the Bots

In Waterboro, Maine, twin brothers Mike and Geoff Howe have spent the past decade inventing and improving a series of self-propelled, diesel-powered, firefighting tractors that they call Thermites.

"Thermite has a very low center of gravity," says Mike Howe. "It is just a little bigger than a common lawn tractor, but it puts out the equivalent of two fire trucks of water." Thermite is now in its third iteration, and the Howes have designed it to be pre-deployed in large factories. The brothers have already sold several dozen to Chinese manufacturers.

"Many firefighters say, 'I don't want to be replaced by a robot'—but our robots are not designed to replace anyone," says Mike Howe. He points to a devastating factory fire in Texas, where ammonium nitrate exploded and took the lives of 12 first responders. "That doesn't have to happen," he says. "We don't have to send 12 firefighters into a factory, waiting for it to explode."

The Howe brothers' system calls for Thermites to be set up throughout a factory, all linked to a mobile command center. If fire strikes, "That command system lights up all the robots and they come out of their small houses and they fight the fire," says Howe.

Autonomous assistants also hold promise for fighting wildland fires, says Brad Koeckeritz, division chief,

The following products are offered by Dixon Fire:

1. **Angle Hose Valves**
2. **Pressure Reducing Valves**
3. **Wedge Disc Gate Valves**
4. **Hose Racks and Reels**
5. **Hydrant Wrenches and Adapters**

"Water drop" DamianPalus/iStock/Getty Images Plus/Getty Images; "fire hose" jonnysek/iStock/Getty Images Plus/Getty Images

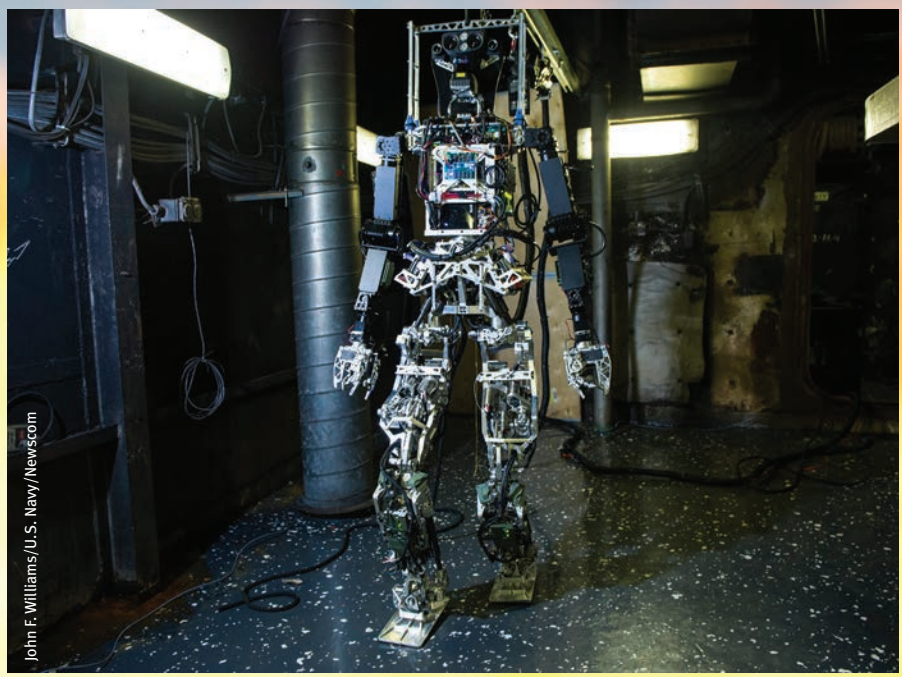
FIGHTING FIRE AT SEA WITH SAFFiR

IN 2014, the U.S. Navy began working with mechanical and computer engineers at Virginia Tech and other universities to design, build and deploy a humanoid robot to attack a sailor's worst nightmare: fire aboard a ship at sea.

"With robots, not being afraid of fire is one of the big advantages," says John Seminatore, a graduate of MIT and Virginia Tech, who worked on what the Navy called SAFFiR (Shipboard Autonomous Firefighting Robot). What's more, he says, "A robot may not necessarily be more fireproof than a person, but a robot can do things that a person can't do, like not breathe. And it can see in infrared and penetrate smoke."

The researchers had good reason for designing their robot to take a human form, says Seminatore. "People asked us, 'Why did you go humanoid? Why go into all the extra complications of balancing and movement?' Well, you've got to work with the space you're working in, and the Navy doesn't want to retrofit its ships. That would cost billions. So you have to use a humanoid form that can walk from room to room, step over doorways, wear the same protective gear as humans and carry the same hoses."

Progress to date has been promising, says Dr. Thomas McKenna, program officer in the division of human and bioengineered systems at the Office of Naval Research. "SAFFiR showed that it could walk down the corridor and take the hose from one end to the other. It did a great job of putting out the fire and knowing where to point the hose.



John F. Williams/U.S. Navy/Newscom

The Shipboard Autonomous Firefighting robot undergoes testing aboard the Naval Research Laboratory's ex-USS Shadwell in Mobile, Alabama.

"The next step," says McKenna, "is to improve mobility"—to equip SAFFiR to handle movements in the ship, use its hands to brace itself, and to design a knee so it can walk up and down stairs.

He expects that humanoid firefighting robots and tiny indoor drone aircraft could be in widespread use on ships "inside of 10 years," though, he says, "this will be determined by market forces."

RileyCaton/iStock/Getty Images Plus/Getty Images

WHAT'S IT WEIGH?

Personal Protection Equipment (PPE) also known as "bunker gear" or "turnout gear," can weigh more than 70 pounds, depending on the tools needed for the job.

LIGHT *4 pounds*

HELMET *6 pounds*

AX *6 pounds*

HALLIGAN HOOK *7 pounds*

HALLIGAN *10 pounds*

BUNKER GEAR (boots, pants, coat, radio, gloves, personal hand tools) *22 pounds*

RESCUE ROPE *26 pounds*

BREATHING APPARATUS *27 pounds*

ROOF SAW *28 pounds*

FIRE EXTINGUISHER *30 pounds*

HOSE (empty) *110 pounds*

It's unlikely that a firefighter will bring every tool to a job. However, a few other factors need to be considered when weighing-in on what it takes to fight a fire: water-soaked turnouts, a charged hose and encountering a person who needs help being evacuated.

WHAT'S IT COST?

A full set of turnout gear runs about $3,000, not counting the SCBA, which is about $6,000.

SOURCE: Haddam Volunteer Fire Company and The New York Times

CoisaX/E+/Getty Images

CoisaX/E+/Getty Images

The Thermite RS2-T1 fire fighting robot comes equipped with integrated multiple HD analog video cameras and optional Infrared FLIR. The Thermite controller is held in a single hand and includes the video monitor attached on top.

Unmanned Aircraft Systems (UAS), for the U.S. Department of the Interior.

"We're still pretty early in the introduction of UAS," he says. Currently, UAS are "embedded at the crew level with firefighters on the ground as a situational awareness and information-gathering tool … but we're looking [ahead] to get bigger aircraft with longer endurance that can stay up 10 or 12 hours at a time and carry infrared cameras to direct the bucket work of our helicopters."

In the near future, Koeckeritz says, "I think we'll see multiple UAS deployed at a major wildfire. The big game-changer would be the ability to move beyond data gathering to an actual tactical role in which an unmanned helicopter is fighting the fire 24/7—at night, and in the early morning when the weather is cooler and the smoke settles near the ground," conditions impossible for human firefighters to work within.

In 2016, Koeckeritz and his team brought an even more futuristic weapon to the war on fire: the "optionally piloted helicopter." Developed by the U.S. military to allow troops to avoid improvised explosive devices along the remote roads of Afghanistan, the K-Max aircraft eventually may be used to fetch, haul and

Thermite 3.0

Howe & Howe Technologies, Inc.

FANNING THE FLAMES

University of Nebraska-Lincoln

A PILOT project with no pilots is adding a new dimension to the growing use of Unmanned Aircraft Systems (UAS) in fire control and management—not by helping to monitor or douse flames, but by igniting them.

In April 2016, at Homestead National Monument in Nebraska, a six-rotor drone with a maximum 1-pound payload was loaded with a dozen golf-ball-sized capsules of flammable potassium permanganate and deployed to touch off a prescribed burn. The UAS, designed at the University of Nebraska-Lincoln, was remotely guided to a swath of restored tall prairie grass, where it dropped its payload, and then returned to its takeoff point for more.

Prescribed burns are key in forest and grassland ecosystem management. These fires encourage natural seed germination and clear the invasive species that can greatly reduce livestock productivity. The use of drones could eliminate the need to send human teams on foot—wielding handheld drip torches—into rugged, flaming terrain.

"We've had a number of fatalities associated with prescribed fires here in Nebraska the last five to six years," says Casey McCoy, acting fire program leader for the Nebraska Forest Service. "This stands to improve the safety of prescribed fire."

University of Nebraska-Lincoln

A University of Nebraska-Lincoln-designed drone returns to the side of a burn area for a reload of fireballs and the chemical to make them burn.

University of Nebraska-Lincoln

The drone drops a fire ball during the April 22 test.

University of Nebraska-Lincoln

The drone takes off on its fifth flight of the test, surrounded by the UNL drone team, media and firefighters.

CoisaX/iStock/Getty Images Plus/Getty Images

drop water and retardant on the most inaccessible zones of a wildland fire, eliminating the hazards that killed those 19 hotshots at Yarnell Hill.

Of course, even with all these advances, says Koeckeritz, "We're a long, long way from replacing anybody with an unmanned system."

Others within the industry agree. "Do not underestimate the volatility of a fire event," warns the NFPA's Casey Grant. "Fires are extremely variable and very difficult to predict. When we talk about robotics, there is a whole competitive effort just focused on being able to go into a situation and climb over debris and perform certain actions—to go into a power plant and turn valves that have been damaged—and do so without any power lines running to the robot itself.

"It will be quite a while before we can get to what we see portrayed in science fiction," says Grant, "but technology is accelerating at a very fast rate."

NASA Photo: Jim Ross

With smoke from the Lake Arrowhead area fires streaming in the background, NASA's Ikhana unmanned aircraft heads out on a Southern California wildfires imaging mission.

In Bar Nunn, Wyoming, Rusty Dunham, is excited about what the future holds for firefighting. "Hopefully," he says, "we can get our line-of-duty deaths down to nothing."

Thankfully, that was the outcome on that scorching July day in Bar Nunn. The powerful gale calmed, the fire was contained. No one was killed, no one was injured, and everybody went home.

"That's the most important thing: that nobody got hurt," says Dunham. "Stuff is just stuff. You can always rebuild stuff."

Everett Collection/Newscom

Helen Keller at the age of 24, when she graduated cum laude from Radcliffe College.

Miracle Girl

Out of her darkness and silence, Helen Keller grew to become one of the most admired people in the world

BY JOAN CATHERINE KRAMER

It was the winter of 1882 and Helen Adams Keller was 19 months old, already walking and talking, a beloved and strikingly determined toddler, when her world went silent and dark.

A mysterious illness—the Keller family doctor in rural Tuscumbia, Alabama, called it brain fever, and speculation today is that Helen had some form of meningitis, or perhaps scarlet fever—rendered her deaf and blind and mute.

"Gradually I got used to the silence and darkness that surrounded me and forgot that it had ever been different," she wrote in her now classic 1903 memoir *The Story of My Life*, "until she came—my teacher—who was to set my spirit free."

"My teacher" was Anne Sullivan, the remarkable young woman, blind herself and newly graduated from the Perkins School for the Blind, who traveled from Boston to the modest Keller cotton plantation and never looked back. She would be Helen's teacher, governess, and then constant companion until she died in 1936 with Helen holding her hand.

When Sullivan first came into her life, Keller was nearly 7 years old. She had only a few rudimentary signs she'd improvised—pushing and pulling, for instance—to make herself crudely understood, and her family was desperate. Frustrated in her desire to express herself, she threw violent tantrums, nearly killing her baby sister in one fit of fury, and relatives were urging her parents to commit her to an institution.

"I do not remember when I first realized that I was different from other people," Keller wrote, "but I had noticed that my mother and my friends did not use signs as I did when they wanted anything done, but talked with their mouths. Sometimes I stood between two persons who were conversing and touched their lips. I could not understand, and was vexed. I moved my lips and gesticulated frantically without result. This made me so angry at times that I kicked and screamed until I was exhausted."

Helen's mother, Kate, came across a piece by Charles Dickens about a blind and deaf girl who had been successfully educated. Kate Keller felt encouraged enough to dispatch Helen and her father to a specialist in Baltimore who referred them to Alexander Graham Bell, whose invention of the telephone had been inspired by his lifelong work with the deaf. Bell, who became a friend, advised

Keller, left, with her devoted teacher, Anne Sullivan.

Everett Collection/Newscom

akg-images/Newscom

Keller graduated from Radcliffe in 1904, with honors in German and English.

> "Suddenly I felt a misty consciousness as of something forgotten—a thrill of returning thought; and somehow the mystery of language was revealed to me."
>
> —Helen Keller

the Kellers to write to the Perkins School, and the director recommended Anne Sullivan.

Sullivan started teaching Keller using a technique called "finger spelling," a gentle, intimate method of communicating hand to hand. For the first few weeks, Keller understood it as little more than a game. And then came the moment—immortalized in *The Miracle Worker*, an Academy Award-winning 1962 film based on Keller's autobiography—when the two took a break from their lessons to walk in the garden. They came to the well house and someone pumping water. Sullivan inserted Keller's hand into the flow, then quickly and repeatedly spelled "w-a-t-e-r" into her other hand.

"I stood still," Keller wrote, "my whole attention fixed upon the motions of her fingers. Suddenly I felt a misty consciousness as of something forgotten—a thrill of returning thought; and somehow the mystery of language was revealed to me. I knew then that "w-a-t-e-r" meant the wonderful cool something that was flowing over my hand. That living word awakened my soul, gave it light, hope, joy, set it free!"

She wanted to know the words for everything—learned dozens of words that very day, including "mother," "father," "sister," "teacher." And if the "miracle worker" of the film is Anne Sullivan, the miracle itself is the child, her spirit so determined to be heard.

Helen Keller's experience of the world is so intense in her telling—she "sees" the delicacy of jasmine and other spring flowers with her eager fingers and highly developed sense of smell. She experiences the coolness of grass with her whole body, delights in the touch of frogs and insects and her dog. Later in life she realizes she can "hear" orchestras by feeling their vibration through the tips of her fingers on a table, that she can "see" and "hear" Niagara Falls by feeling the earth and the very atmosphere tremble around her.

Sullivan accompanied her to Boston, where she became a star pupil at the Perkins School, learning to read raised

letters, then Braille, decoding the mysteries of the world's great books and attracting the attention of journalists and philanthropists to the cause. The two moved to New York, where Keller studied with another extraordinary teacher, Sarah Fuller of the Horace Mann School for the Deaf, who helped her realize one of her great ambitions—to be able to speak. The process was laborious and involved Keller feeling the lips and throat of her speaker/teacher and working to imitate the vibrations she felt with her own lips and throat. Over the years, Keller became adept at reading lips with her fingers.

She wanted to go to Harvard, and when that was ruled out—they did not accept women—she settled on Radcliffe. Everyone told her it could not be done, but the determination that once made her kick and scream and destroy things propelled her through prep school,

Keller and her companions traveled [the] world, raising money for the blind, advocating for equal rights for women and the disabled, giving inspirational speeches.

Sullivan always at her side, literally holding her hand and speaking into it lectures, exam questions, conversations.

Keller passed the same test everyone had to take and got into Radcliffe. While she was there she wrote *The Story of My Life* (there would be a half-dozen more books). It was first serialized in *Ladies Home Journal* and would become an award-winning play, then the film, then a TV movie.

Everywhere she found helpers, wealthy donors inspired to pay her tuition, to support her. Samuel Clemens (better known as Mark Twain), who became a good friend, introduced her to an oil magnate who put her through Radcliffe. She graduated cum laude, with honors in German and English. At one point, even industrialist Andrew Carnegie insisted on contributing to her support.

Below, left: Helen Keller with writer Mark Twain, who became her good friend. Right: Keller teaching a child sign language in 1907.


Mondadori Portfolio/Newscom


World History Archive/Newscom

Helen Keller, c. 1950's

Sullivan married, but after a year or two her husband drifted away. Keller in her 30s had a love affair with a newspaper reporter who came to fill in as her secretary. These things didn't last. But Polly Thomson, who came to live with the women as a housekeeper, learned their special language and stayed with them until she died in 1960. Winnie Corbally, a nurse hired to care for Thomson, stayed with Keller as her companion until Keller herself died in her sleep just shy of her 88th birthday.

From the dark silence of her early childhood, Helen Keller grew to become one of the most admired people in the world. She and her companions traveled that world, raising money for the blind, advocating for equal rights for women and the disabled, giving inspirational speeches. Her message was love, the joy of service. She was a suffragette, an enthusiastic Socialist, an advocate for birth control. She helped found the American Civil Liberties Union. She met every U.S. president from Grover Cleveland to Lyndon Johnson, who in 1964 awarded her the Presidential Medal of Freedom.

Her only regret, she said in a taped 1954 interview, was that despite years of dogged practice, she never was able to make herself understood when she spoke. "Longingly I feel how much more good I may have done, if I had only acquired normal speech," she said aloud, as Polly Thomson repeated her words to make them more clearly understood. "But out of this sorrowful experience, I understand more fully all human strivings, thwarted ambitions, and the infinite capacity of hope."

THE DIXON DRILLER

"Published once a moon since 1932"

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Did you know that...

TRIVIA

The first bathing suit was worn in Greece in 350 B.C. Later, togas were worn when swimming. Bathing reached the height of its popularity in the ancient world.

About one-quarter of the world's lemons are grown in the U.S., and California is home to the most lemon trees.

Scientific experiments have established that on average a single-scoop ice cream cone takes 50 licks to eat. About 98 percent of American households buy ice cream each year.

The Sun is about 93 million miles from Earth, and light from it takes about eight minutes to make the trip.

The Chinese invented and wore the first pair of sunglasses more than 2,000 years ago.

The three American cities with the highest per capita consumption of ice cream are: Portland, Oregon; Seattle, Washington; and St. Louis, Missouri.

Once upon a time, American men were required to wear a skirt with their bathing suit. According to "Bathing Suit Regulations" published on May 17, 1917, men's suits had to be worn with a skirt or have at least a skirt effect. The skirt had to be worn outside of the trunks.

A lemon tree bears about 3,000 lemons each year. Now that's a lot of lemonade!

The first ice cream parlor opened in 1776, in New York City.

Our eyes get 80 percent of their total UV exposure by age 18. So it is never too early for kids to start wearing sunglasses.

The longest word that can be typed using only the right hand is "lollipop."

hubpages.com

ON THE LIGHTER SIDE

Which military unit has the most kids? *The infant-try*

What kind of car does a cook drive? *Chef-rolet*

Why did the bird go to the doctor? *For medical tweet-ment*

Why did the bacon laugh? *Because the egg cracked a yolk*

Where do belly buttons go to learn? *The Naval Academy*

What has 10 letters and starts with G-A-S? *Automobile*

What's the difference between a well-dressed man and a tired dog? *One wears a suit; the other just pants.*

What did the dragon say to the knight? *No more canned food!*

What is the Three Stooges' favorite snack? *Curly fries*

Why does it take so long for pirates to learn the alphabet? *They could spend years at C.*

jokes.boyslife.org

Dates in History

1698:
On July 2, Thomas Savery patented the first steam engine. The device was essentially a pressure vessel that raised water partly by the direct pressure of steam, and partly by condensing the steam to create a vacuum, thus allowing the water to be raised by atmospheric pressure.

1799:
On July 15, the Rosetta Stone was found in the Egyptian village of Rosetta by French Captain Pierre-François Bouchard during Napoleon's Egyptian Campaign. The stone is inscribed with three versions of a decree issued at Memphis, Egypt, in 196 B.C., on behalf of King Ptolemy V. The stone proved to be the key to deciphering Egyptian hieroglyphs.

1815:
On July 9, Capt. James Wilson accidentally discovered the first developed natural gas well in the United States while he was drilling for salt at Burning Springs, near present day Brooks Street, in Charleston, West Virginia.

1908:
On July 4, SOS was adopted as the international distress signal. SOS is the only nine-element signal in Morse code. The first ship to transmit an SOS distress call appears to have been either the Cunard liner *RMS Slavonia* or the steamer *SS Arapahoe*, both in 1909.

1951:
On July 16, *The Catcher in the Rye*, by J. D. Salinger, was published by Little, Brown and Company. Around 1 million copies are sold each year.

popculturemadness/trivia/july.com

Patriot's Tour

Summer is the perfect time to visit three history-steeped cities that played a starring role in our nation's founding

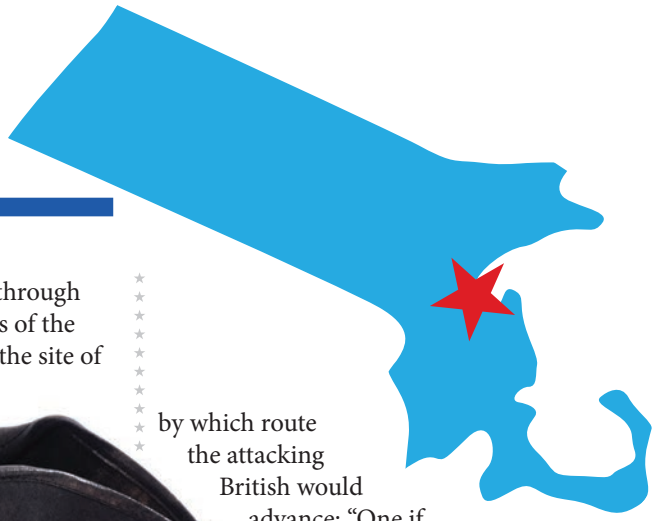
BY SARAH ACHENBACH

While important historical events unfolded all over the 50 United States, a trip to the Big Three—Boston, Philadelphia and Williamsburg—is key to fully understand the "how and why" of the country's founding. Shake off those memories of your childhood visits to musty, no-touching-allowed historic sites. Today's would-be patriots can jump into the stories of the American Revolution through interactive tours, multimedia magic and hands-on history for learning and fun they won't soon forget.

★ ★ ★ ★ ★

MarianVejcik/iStock /Getty Images Plus/Getty Images

Boston, Massachusetts



The American Revolution began in Boston, so start your tour by getting riled up Revolutionary-style at the **Boston Tea Party Ships and Museum** (bostonteapartyship.com). Cheer at a Colonial town meeting and then witness the events leading up to Dec. 16, 1773—the night the Sons of Liberty dumped tea into the Boston Harbor—in high-tech, holographic splendor by watching the museum's state-of-the-art film. Then it's time to dump "bales" of tea overboard from replica ships.

To get the full flavor of the city, walk through history on the **Freedom Trail**, a meandering 2.5-mile stroll that connects 16 historically significant sites. To get the full effect, pony up the money for a public or private tour: An 18th-century costumed Freedom Trail Player will lead your family through the events, stories and heroes of the American Revolution, from the site of

"Colonial Hat" skodonnell/iStock /Getty Images Plus/Getty Images

the **1770 Boston Massacre** (where five colonists famously died, arguably the first fatalities of the Revolutionary War); to the **Old North Church** (where lanterns were hung to signal when and by which route the attacking British would advance: "One if by land; two if by sea"); and the **Paul Revere House**, home of the "Son of Liberty" who made the midnight right to Lexington to warn that the British were coming. It's worth noting that the house is the birthplace of another American original: the Mary Jane candy, which has been made on-site for decades by the Charles N. Miller Company. (Sweeten the historical connection by telling your kids that Revere sometimes practiced

Mel Longhurst/Photoshot/Newscom

Boston Tea Party Ships and Museum

The Boston Tea Party Museum features a replica of *Eleanor*, an original Boston Tea Party ship. *Eleanor was* one of several vessels owned by leading Boston merchant, smuggler, and Boston Board of Selectman John Rowe. He was so angered by British policy that he was influential in inciting the destruction of his own cargo aboard his ship.

FREEDOM TRAIL

Left to right: Freedom Trail Players in front of the Old State House, an official Freedom Trail Historic Site; Copp's Hill Burying Ground is the second-oldest burying ground in the city; a Freedom Trail Player guides tourists through the Granary Burying Ground, where Paul Revere is buried.

as a dentist.) Tours run year-round; you also may walk the Freedom Trail at your own pace by downloading the app at thefreedomtrail.org.

To step into the fascinating history of African-Americans' key role in the American Revolution, follow **The Black Heritage Trail**, a free guided or self-guided walking tour of 14 locations of schools, homes, churches and Underground Railroad sites. Many African-Americans fought alongside white colonists in the battles of Bunker Hill and Lexington and Concord, and by the end of the American Revolution, Boston's free blacks outnumbered its slaves. Tours depart from the **Robert Gould Shaw and 54th Massachusetts Regiment Memorial** and end at the nation's first **African Meeting House**.

AFRICAN MEETING HOUSE

OLD NORTH CHURCH

Built in 1723, the Old North Church, also known as Christ Church in the City of Boston, is Boston's oldest surviving church building and one of its most visited historical sites.

Bdphoto/iStock /Getty Images Plus/Getty Images

"African Meeting House," Museum of African American History, Boston & Nantucket

Red, White and Blue ... and Green

GARDENS AND GREEN SPACES PLAYED KEY ROLES IN THE FOUNDING OF THE UNITED STATES. IT'S EASY BEING GREEN WITH VISITS TO THESE HISTORIC GARDENS AND PARKS.

Boston Common

zrfphoto/iStock/Getty Images Plus/Getty Images

Boston Common (139 Tremont St. Boston, Mass.): America's oldest public park was founded in 1634. Its 44 acres in the heart of the city were the grazing site for local livestock. It served as a "trayning field" and eight-year encampment for more than 1,000 Redcoats during British occupation. Over the decades in the Common, Bostonians hung pirates from the now-gone "Great Elm"; enlisted in the Civil War; planted World War I victory gardens; and marched with Martin Luther King Jr. at an anti-Vietnam War protest. Today, it's perfect for people-watching, picnicking, playing baseball or enjoying the Frog Pond's spray pool in the summer and its ice-skating rink in the winter.

Bartram's Garden (5400 Lindbergh Boulevard, Phila., Pa.): This 45-acre "living" laboratory and outdoor classroom is less than 15 minutes by car from Center City, Philadelphia, and accessible by public transportation. John Bartram, a self-taught Pennsylvania Quaker and friend of Benjamin Franklin—they co-founded the American Philosophical Society—traveled the colonies and beyond to collect the most varied collection of North American plants in the world. The city took ownership of the garden in 1891, and today the John Bartram Association manages it in cooperation with Philadelphia Parks and Recreation. Open year-round for free, with self-guided tours, ticketed tours with a docent, and programs, Bartram's Gardens is also the perfect place to enjoy another natural Philly resource: the Lower Schuylkill River. Saturdays from July through October, take a free kayak or rowboat ride from the **Bartram's Garden Community Boathouse**.

Colonial Williamsburg Foundation

Colonial Garden and Nursery

There are plenty of beautiful, period gardens at **Williamsburg**. Take a tour, visit the **Colonial Garden and Nursery**, or attend a Meet a Gardener program. But your kids will probably just want to dig in the dirt. Each day, weather permitting, kids ages 5 to 16 may sign up to work alongside Colonial Williamsburg archaeologists excavating the cellar of Archibald Blair's 18th-century store on Duke of Gloucester Street. Sign up at the Colonial Street entrance at 9 a.m.: colonialwilliamsburg.com/plan/calendar/dig-kids-dirt-discovery.

Bartram's Garden/copyright 2017

1810 Yellowwood at Bartram's Garden

PHILADELPHIA, PENNSYLVANIA

Photo by G. Widman for Visit Philadelphia™

INDEPENDENCE HALL

AMERICA'S BIRTHPLACE is best experienced on foot. The 1.25-mile Constitutional Walking Tour is a great way to experience the **Independence National Historical Park** area and its more than 20 historic sites: Independence Hall, the Liberty Bell, the Betsy Ross House and more. You can even turn it into a scavenger hunt, with a reservation through the Constitutional Walking Tour company (theconstitutional.com). Your group will receive clues and compete against other teams to find answers at sites in and around historic Philadelphia. At the end, you'll meet up with a trained "History Hunter" to find out the results—and ideally win top prize.

High-tech, high-touch elements abound at Philadelphia's many museums dedicated to preserving our country's founding. Don't miss the **National Constitution Center**, where the most famous words in the United States spring to life. Start your visit there with "Freedom Rising," a live, 360-degree theatrical performance (free with general admission) that tells the story of the U.S. Constitution and the American quest for freedom.

Philadelphia's newest gem, the **Museum of the American Revolution**, opened in April 2017, with 3,000-plus artifacts, manuscripts and more from the Revolutionary period, including Gen. Washington's Headquarters Tent. Start your journey by exploring a massive, interactive map of the North American continent. Then watch Congress issue the Declaration of Independence from the comfort of your very own Windsor chair in an immersive theater. You can also join the Sons of Liberty under a life-size "Liberty

Photo by G. Widman for Visit Philadelphia™

THE NATIONAL CONSTITUTION CENTER

The world's only museum dedicated to the U.S. Constitution, the National Constitution Center puts into historical context the most famous four pages ever written through high-tech exhibitions, artifacts and interactive displays. A live narrator narrates the multimedia "Freedom Rising" show, a moving presentation of the nation's story.

"Quill and Inkwll" DNY59/iStock/Getty Images Plus/Getty Images; "Liberty Bell" orderfinishedart/iStock/Getty Images Plus/Getty Images

Photo by C. Smyth for VISIT PHILADELPHIA®

Museum of American Revolution

The museum houses a life-size reproduction of the Boston Liberty Tree, a large elm tree where the first stirrings of revolt were discussed and debated. Liberty Trees became gathering places for the Sons and Daughters of Liberty, groups of men and women who rebelled against British tyranny.

Tree." And in the panoramic Battlefield Theater, you'll experience the frenzy of an advancing British infantry charge at the Battle of Brandywine.

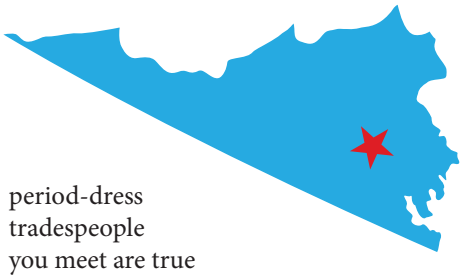
Before you leave Philadelphia, be sure to spend time learning about America's original Renaissance man, Benjamin Franklin. At the **Benjamin Franklin Museum**, explore the man who gave us the bifocal, lightning rod, political cartoon, public library, volunteer firefighter and the postal system—and who co-authored the Declaration of Independence. You can literally trace big Ben's path with the Franklin's Footsteps Itinerary, discovering historic places he frequented, sites dedicated to him, and even restaurants that would have appealed to him.

Benjamin Franklin Museum

Franklin Court includes the newly opened Benjamin Franklin Museum and the Ghost Structure, which marks the site of Franklin's home.

Photo by J. Fusco for Visit Philadelphia™

Williamsburg, Virginia



Every step in Colonial Williamsburg is a step through history. To ensure that your family's visit is steeped in Colonial times, go digital: The Colonial Williamsburg free, mobile app (colonialwilliamsburg.com/mobile-app) gives real-time updates on interactive programs and tours, and pop-up notifications on where to find the Colonial celebrities that roam the grounds—Martha Washington, Thomas Jefferson and others (including the friendliest of all Williamsburg "re-enactors," George Washington's dog, Liberty).

There is a lot to do in the nation's largest living history museum. Every structure and street is authentic to what life was like in a bustling 18th-century city when Williamsburg was the capital of Virginia. Learning about a Colonial trade is great but don't try to see every tradesman. Pick a few—the blacksmith, the cooper, the bindery, the munitions shop, whatever interests your family members—and spend time there. The period-dress tradespeople you meet are true craftspeople working with real 18th-century tools and techniques, and many will let you try your hands at a trade. During the summer, you can even help bricklayers by stomping water into clay with your bare feet.

Immersion is the point of the place where rumblings of freedom from England first stirred. At the recently restored **Market House**, you can pick up some Colonial gossip and rent period costumes. Visit the **James Geddy House** for games, dancing and chores your child will actually want to do. At the **Peyton Randolph House**, meet re-enactors who share the experiences and struggles of the

Colonial Williamsburg Foundation

James Geddy House

The James Geddy House is one of the original buildings in the Historic Area. A unique feature of the house is its L-shape house plan, uncommon in Williamsburg, which may have been adapted to fit the corner location.

Real or Not Real?

Of the many properties and structures at Colonial Williamsburg, 88 are original. The rest have been painstakingly restored or crafted with period details and techniques. Before you visit, bookmark the list of original structures (research.history.org/research/architecture/buildings/original-buildings). As you traverse the streets of Colonial Williamsburg, ask your kids if they think a building or structure was restored or reconstructed. When Colonial Williamsburg was founded in 1926, restoring an entire town was unprecedented. Architects, designers, historians, archaeologists and craftspeople researched, renovated and reconstructed grand homes as well as commonplace workshops and smokehouses.

The Market House

Colonial Williamsburg Foundation\David M. Doody

Colonial Williamsburg Foundation/David M. Doody

Peyton Randolph House

The deep red Peyton Randolph House is one of the oldest, most historic and most beautiful of Colonial Williamsburg's original 18th-century homes.

enslaved people in Colonial America. At **The Magazine**, hear members of the Native American delegation talk about what it was like to be a soldier. And don't miss The Magazine's daily Firing of the Noon Gun and Running of the Engine.

Don't rush back to the hotel at sundown, though. Dinner at a historic tavern is a fun Williamsburg tradition, and two new programs in **Raleigh Tavern** give an extra layer of history. "The Magic Parlour" offers Colonial-era magic tricks, and "Escape the King" puts you in a locked room with other patriots to solve clues to escape the king's wrath. When the hour is up, a British officer interrogates you. Two ghost walks—one with family-friendly ghost stories; the other where families (with older children) enter haunted properties—add mystery. And in the evening, characters portraying the slaves who lived and worked at **Great Hopes Plantation** share the music and dance of African-American musical culture in Colonial Virginia.

Colonial Williamsburg Foundation/ David M. Doody

Raleigh Tavern

The Lost Colony at Roanoke

America's oldest mystery story still waits to be solved

BY SUE DE PASQUALE

After more than 425 years, it's a mystery that still captures the imagination—inspiring anthropologists, archaeologists, playwrights and amateur history buffs to search for answers: How and why did the 100-plus men, women and children who were left on Roanoke Island to establish the first permanent English settlement seemingly vanish off the face of the Earth?

The story starts back in England in March 1584, with Queen Elizabeth I granting Sir Walter Raleigh a prized charter to colonize the sprawling region of North America. The queen wanted access to the rich resources of the continent, and perhaps more importantly, was intent on establishing a military base there to gain advantage against Spain's treasure fleets.

Raleigh tapped his friend John White, an artist and mapmaker, to lead the 1587 expedition that would establish a new colony on the Chesapeake Bay. White's intent was to swing by Roanoke Island to check on a garrison of 15 soldiers who had been left during an exploratory mission the previous year. Then the group would sail 100 miles up the Chesapeake by late spring, in time to plant crops and establish a colony on the mainland. White was confident enough of success that he included his family on the voyage: his wife, pregnant daughter and son-in-law.

But events did not go as planned. The ship's captain, Simon Fernandez, lost his bearings more than once, despite having sailed the waters before. The delays piled up. By the time the group finally disembarked on Roanoke Island it was mid-July. Ominously, they found the garrison partly razed, with only a skeleton—believed to be that of a soldier—left to greet them.

Fernandez determined that it was too late in the season to sail farther up the Chesapeake as originally planned. He refused to go and instead ordered the colonists off the ship and onto the island—a 12-mile-long spit of land sandwiched between what is today the Outer Banks and the mainland of North Carolina.

Within a month, White was blessed with a birth of a granddaughter. Tiny Virginia Dare became the first English child born in the Western Hemisphere.

But any cause for joy was fleeting. Low on provisions, with winter right around the corner, the colonists faced a desperate situation. They convinced White to sail back to England to ask for help. He left late in 1587, though not before first attempting to establish good relations with the local Croatoan

Baptism of Virginia Dare

"Baptism of Virginia Dare," Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Baptism_of_Virginia_Dare.jpeg

Ken Welsh/Newscom

Above: John White discovers the word Croatoan carved into a tree upon his return to the deserted Roanoke Colony in 1590.

Indians and other tribes. He hoped to return within a matter of months with fresh supplies and reinforcements.

But that plan was stymied when the Spanish Armada attacked England. The Anglo-Spanish War ensued. White tried desperately to get hold of a ship to return to his family on Roanoke but met failure at every turn. Three long years passed before he could finally mount a successful resupply attempt. He landed back on Roanoke Island on Aug. 18, 1590—his granddaughter's third birthday.

White and his men found the settlement completely deserted. There was no trace of a single human being, no sign of a battle or struggle. The only clues left: the word "CROATOAN" carved into a post of the village, and the letters "C-R-O" carved into a tree.

The legend of the Lost Colony at Roanoke was born—America's oldest mystery story.

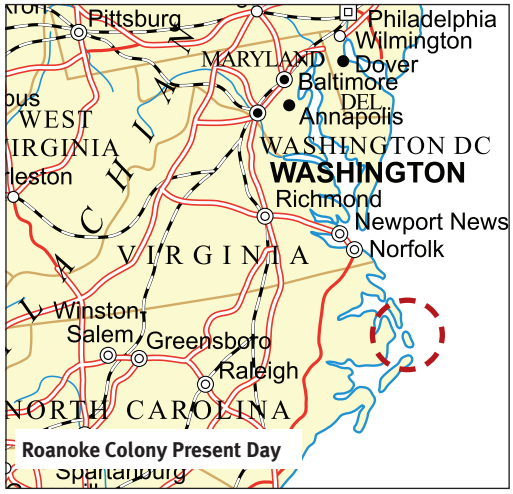
For centuries, it was believed that the colonists perished at the hands of the Powhatan tribe. That was the account supplied by none other than Capt. James Smith, leader of the Jamestown Colony from 1608 to 1609. The Jamestown colonists had mounted several search efforts to look for their lost predecessors before learning ghastly news: The Powhatan chief boasted of conducting the slaughter of the colonists himself, shortly before the Jamestown colonists arrived.

According to this story, the colonists had made their way inland and were living among a rival Indian tribe for 20 years before the massacre by the Powhatans occurred. Capt. Smith, eager to end resource-sapping search efforts, reported the news back to King James and the royal court.

Case closed, as far as England and the Jamestown colonists were concerned.

Yet doubts persisted. Why were no bodies ever found? Why was

Roanoke Colony 1584



Roanoke Colony Present Day

"Current Map" dikobraziy/iStock/Getty Images Plus; "Roanoke map 1584" Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Roanoke_map_1584.JPG; published in the U.S. before 1923 and public domain in the U.S.

Miller theorizes that most of the women and children were taken as slaves by various Indian tribes, then dispersed throughout the Carolinas through part of a vast Indian trading network.

there no archaeological evidence to support this version of events?

Over the last two decades, provocative new theories have surfaced. In her 2000 book *Roanoke: Solving the Mystery of the Lost Colony*, anthropologist Lee Miller provides evidence that the "lost colony" wasn't lost. It was sabotaged.

She contends that the colonists were the unlucky victims of a conspiracy, masterminded by the wily Sir Francis Walsingham, secretary of state to Queen Elizabeth I. Miller believes Walsingham wanted to take down Sir Walter Raleigh—the queen's "golden boy," by dooming efforts to establish a colony.

Miller's theory is that boat pilot Fernandez was part of the plot to deliberately strand the colonists on Roanoke Island, where they would either starve, be raided by the Spanish or die from Indian attacks. To seal their grim fates, Walsingham thwarted John White's attempts to return quickly with supplies until three long years had passed.

Miller cites primary accounts that colonists had been spotted over the decades within the interior (*"We saw a savage boy, about the age of ten yeeres, which had a head of haire of a perfect yellow and a reasonable white skinne, which is a miracle amongst savages"*) to offer up this version of events: When White didn't return, the colonists moved inland. Most of the men were probably killed by warring Indian factions. Others may have landed with the friendly Croatoans (as their carvings suggested).

ZU_og/DigitalVision Vectors/Getty Images

This engraving was based on a c. 1585 drawing by John White, which depicted the Native American Village of Secotan on Roanoke Island. British Museum, London.

But Miller theorizes that most of the women and children and were taken as slaves by various Indian tribes, then dispersed throughout the Carolinas through part of a vast Indian trading network.

While the conspiracy part of Miller's theory is next-to-impossible to confirm, her ideas about assimilation are shared today by a variety of archaeologists and historians.

In 2004, the nonprofit First Colony Foundation joined the search to find answers. A big break came in 2011. That's when a foundation member noticed two patches in a 425-year-old map that had been painted by John White. The map, which depicted the North Carolina coastline, was held in the British Museum. Using X-ray spectroscopy and other new imaging techniques, scientists looked beneath the patches. Under one, they found a blue-and-red symbol—depicting a fort—about 60 miles west of Roanoke Island.

It's here, at a spot now dubbed "Site X," that some believe the colonists tried to resettle. This would fit with White's written version of events—that the colonists planned to move "50 miles

The Print Collector Heritage Images/Newscom

Joe Sohm Visions of America/Newscom

Left, a 19th-century image depicts the murder of White's assistant. Above, a gravestone commemorating the Lost Colony at Roanoke.

into the maine" once he returned from England with supplies.

First Foundation has now established an archaeological dig at Site X—which sits on the bank of Albemarle Sound near Edenton, North Carolina—with some intriguing results. In addition to other artifacts, archaeologists have discovered shards of Surrey-Hampshire Border ware, ceramic ware that was only produced until 1624. The artifacts "suggest the likelihood that a small number of Roanoke colonists were present at Site X for an undetermined length of time," the archaeologists conclude.

New York University historian Karen Ordahl Kupperman, who has studied the mystery for years, calls this latest conclusion "a very exciting possibility." She believes that the colonists probably divided up into groups and then assimilated into local Indian communities. The Border ware find would support that theory.

If at least some of the "lost" colonists survived to assimilate with surrounding Indian tribes, then the proof should be in the DNA. At least that's the strategy adopted by the Lost Colony of Roanoke DNA Project, led by Roberta Estes, who owns a private DNA-testing company. Project leaders have been analyzing historical records, migration patterns and oral histories, and employing DNA testing. So far, despite their cutting-edge tools, they have come up empty, unable to positively identify any descendants of the colony.

We may never know what really happened to the 117 men, women and children who bravely set out to establish the first American colony. But our fascination won't die—witness the millions who have flocked to watch the outdoor performance of "The Lost Colony," performed each summer since 1937 on North Carolina's Outer Banks.

The "grandfather" of all outdoor dramas, it is produced by the Roanoke Island Historical Association. The group's goal? "To honor the founders of the Lost Colony" whose "dream still lives on."

Pump Cavitation Got You Down?

One-Piece Suction Manifolds

> DIXON'S DEVELOPMENT of the one-piece suction manifold, which feeds slurry into high-pressure pumps, is an example of Dixon innovation at its best. The manifold design came in response to needs expressed by hydraulic fracturing companies; they were experiencing pump cavitation due to proppant dropout, which causes destructive flow restrictions.

End user input is invaluable, and the feedback has helped guide our direction on an economical solution.

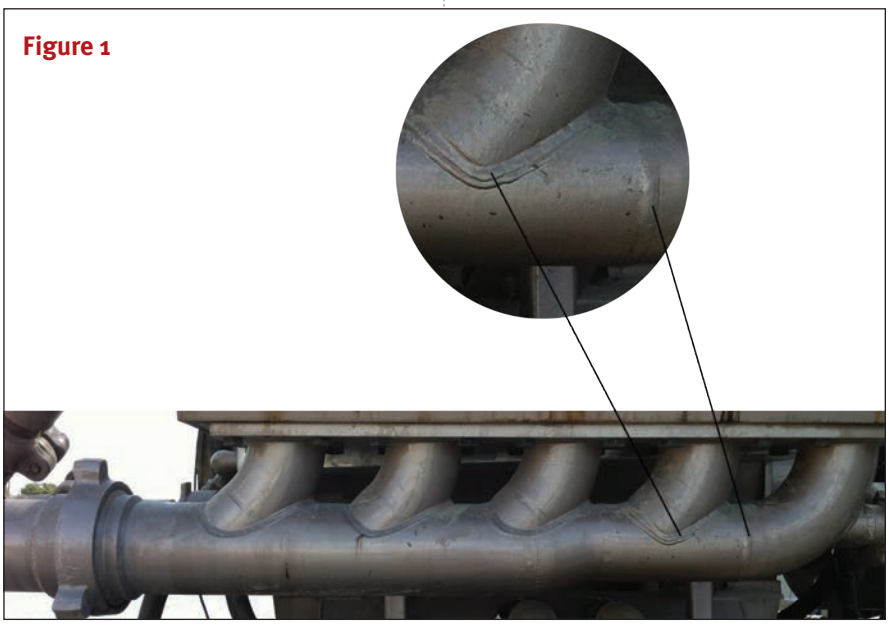
Feedback on Manifolds:

- Sand dropout causes flow restrictions, and pump cavitation is common.
- Traditional welded pipe manifolds create turbulence, causing excessive abrasion on internal walls.
- Leaks along the weld seams are a regular nuisance.
- Acidizing well treatments attack weld seems.
- CO2 transfers at -30°F temperatures, and can cause performance issues.
- Repairs consist of re-welding and/or using rubber washers with screws.

Sand dropout and internal weld corrosion inside a welded pipe manifold

Figure 2

Figure 1



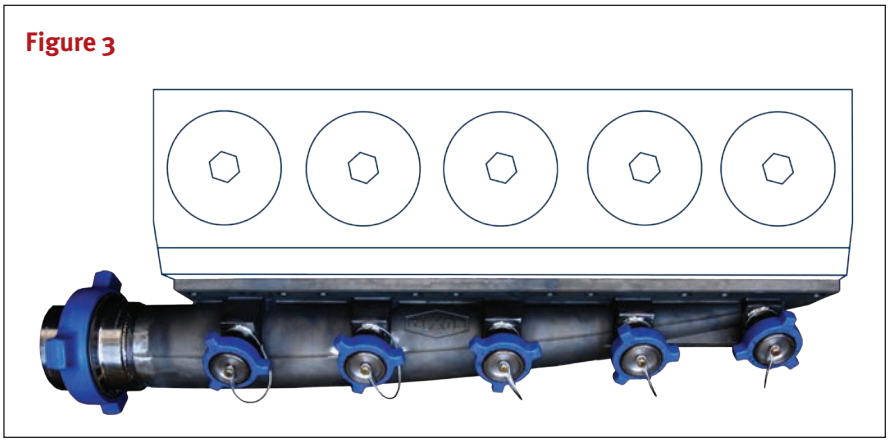
Traditional welded pipe manifold; callout shows 2 weld seams

Within the hydraulic fracturing operation there are multiple scenarios where down-time and pump failure can be avoided. Figure 1 shows a traditional welded pipe manifold. Figure 2 exhibits sand dropout and internal weld erosion.

The Dixon design combines unique flow geometry with one-piece iron manufacturing technology to increase flow and eliminate 7 to 18 leak-prone weld seams. The 3-Port and 5-Port suction manifolds are

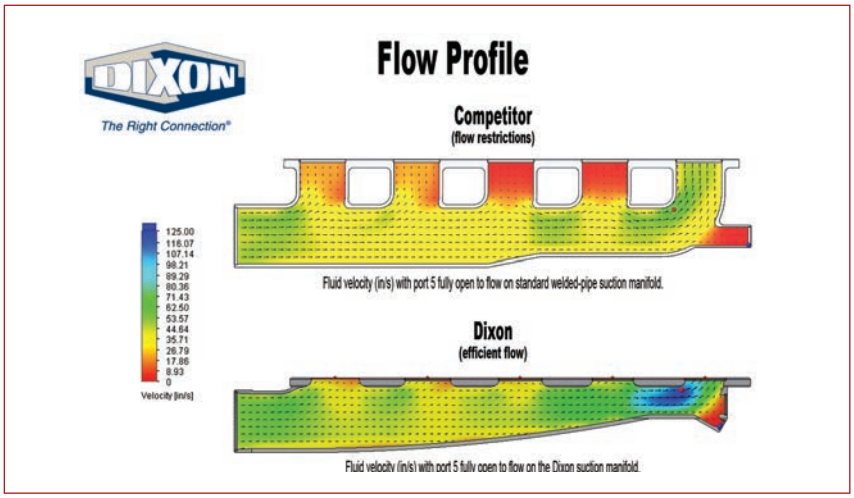
Dixon's 5-Port intake manifold designed for efficient fluid flows to eliminate pump cavitation caused by sand fallout.

Figure 3



patented for use with HHP pumps, and have been lab and field tested. The flow profile simulation demonstrates the differences between the standard welded pipe and the Dixon manifolds.

Dixon has been building a credible reputation for more than 100 years, by manufacturing products that are safe, reliable and long lasting. By maintaining open communication with customers and following through with solutions, we strengthen trust as a supplier of both current and future products.



HOW CAN DIXON HELP YOU?

For more information, visit www.dixonvalve.com or call (877) 963-4966.

Foe of Aging Eyes

Age-related macular degeneration robs central vision, creating "blind spots" straight ahead

> AS YOU AGE, you may start to notice your body changing—metabolism slows down, joints feel creakier. While some symptoms of getting older come with the territory, others shouldn't be ignored—your vision chief among them.

If you have any vision loss, see wavy lines or spots, or experience blurred or distorted vision, it's time to make an appointment with an ophthalmologist. These could be signs of a progressive retinal condition called age-related macular degeneration (AMD), the leading cause of vision loss in those over 60. As the population ages and people live longer, the disease will affect a larger percentage of Americans.

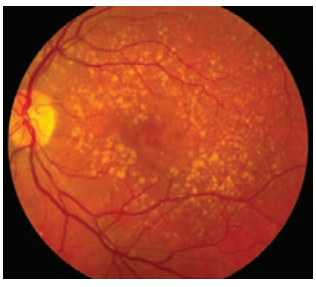
"Most patients come to see me when they are experiencing some sort of functional deficit with completing an everyday activity, such as reading small print, seeing street signs or recognizing faces," says Ashley Deemer, an ophthalmologist at the Wilmer Eye Institute at Johns Hopkins Hospital in Baltimore, Maryland.

Many come in asking for glasses. But if they do have AMD, glasses won't do much to improve vision, she says. Think of your eyes like a camera. "The glasses are the lens of the camera, and the retina is the film of the camera. If the film is damaged in any way, no matter what we do with the lens, the picture will still be blurry."

Bill Oxford/E+/Getty Images

Healthy Eye

Eye with AMD



AMD is caused by the deterioration of the macula, the central part of the retina, which is responsible for recording what we see and sending it to the brain. The macula controls central vision. When it deteriorates, this causes "blind spots" directly ahead, affecting your ability to read, drive, recognize faces and colors, and see detail.

There are two kinds of AMD: dry and wet. Dry AMD is caused when yellow deposits, called drusen, form on the retina beneath the macula, causing the retina to deteriorate over time. The larger and more prevalent the drusen are, the worse vision gets. Most cases of AMD are classified as dry, which tends to progress more slowly than the wet form.

About 10 to 15 percent of those with AMD have the wet form, which is caused by abnormal blood vessel growth

"Eye Image (left)" hidesy/iStock/Getty Images Plus/Getty Images; "Eye image (right)" Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Intermediate_age_related_macular_degeneration.jpg

under the macula. The vessels and their discharge eventually form a scar, leading to irreversible central vision loss.

What can you do to prevent the condition? Not much, unfortunately, says Deemer, since the main risk factors are mostly out of your control: advancing age and genetics (AMD is more common in Caucasians than African-Americans and Hispanics). That said, some may be able to prevent or slow AMD by maintaining a healthy lifestyle—that means not smoking (which more than doubles your risk), protecting your eyes from UV exposure and eating a diet rich in leafy greens and fish.

Of course, if you're diagnosed with AMD, you want to know what that means for your future vision. "Macular degeneration is a chronic disease. It involves years of follow-up with an eye care provider and is something that is never really cured," says Deemer. "One thing I tell my patients, however, is macular degeneration will never cause you to go completely blind. Central vision and clarity may decrease to the point of legal blindness, but peripheral vision is always spared."

To slow the progression of AMD, patients with wet AMD can get eye injections that block buildup of a particular protein that promotes blood vessel growth in the eye. Some doctors may recommend laser therapy or surgery to destroy growing vessels. While there isn't much that can be done about dry AMD, a large study by the National Eye Institute found that taking a supplement with vitamins C and E, beta-carotene, zinc and copper lowers the risk of vision loss.

Learning to cope with the vision loss that comes with AMD is important. Specialists can suggest low vision devices, such as magnifiers, large-print reading materials, talking watches and calculators, and computers with large print and speech output systems.

Advancing technology is already beginning to brighten the picture. An implantable miniature telescope, approved by the Food and Drug Administration in 2010, may help some with dry AMD. The pea-size device magnifies images—two to three times their original size—onto the retina to improve central vision.

What's more, "There are now some portable, head-mounted devices that can electronically magnify and enhance contrast through a cellphone camera," says Deemer. "This type of technology can only be expected to improve as we continue to develop technologically."


Vision without AMD

Courtesy iStock/Getty Images Plus/Getty Images


Vision with AMD

Courtesy iStock/Getty Images Plus/Getty Images

TYPES OF EYE SPECIALISTS

Ophthalmologist
An ophthalmologist is a medical doctor who specializes in eye and vision care.

Optometrist
An optometrist is not a medical doctor. Optometrists are healthcare professionals who provide primary vision care ranging from sight testing and correction to the diagnosis, treatment, and management of vision changes.

Optician
Opticians are technicians trained to design, verify and fit eyeglass lenses and frames, contact lenses, and other devices to correct eyesight.

SOURCE: https://www.aapos.org/terms/conditions/132

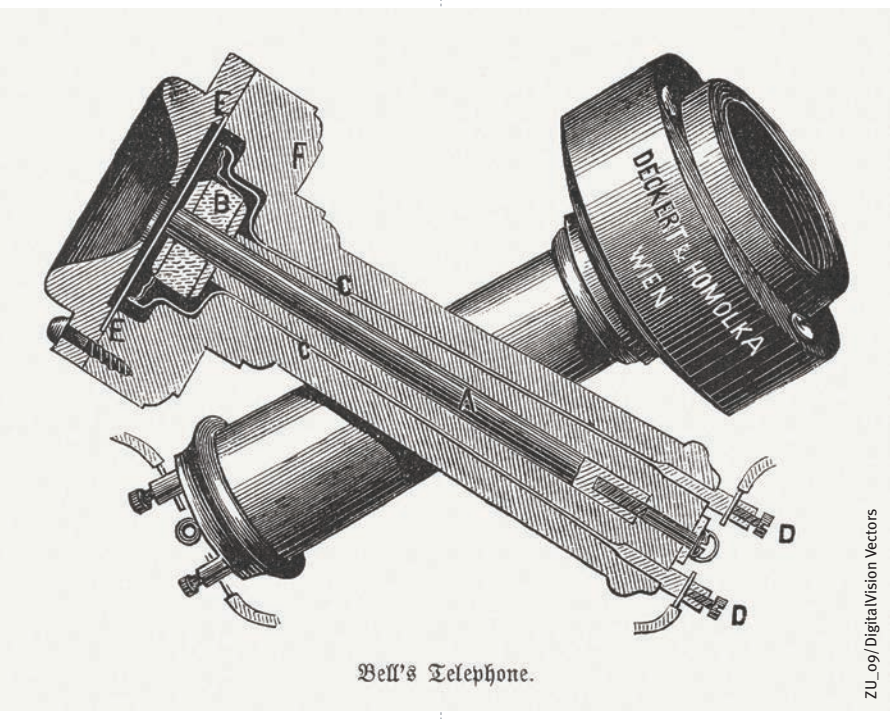
Hold the Phone!

Alexander Graham Bell revolutionized communication with his invention of a 'talking telegraph'

> IN THE MID-TO-LATE 1800s, a few inventors were working on versions of a talking telegraph. But it was Alexander Graham Bell who successfully won the first patent for the telephone in 1876—and revolutionized communication in the process.

Bell was born in Scotland and settled in Boston in 1871, where he worked as a teacher for hearing-impaired students at various schools in New England. In the 1870s, he began working with Thomas Watson—whom he met at a Boston electrical shop—on building a harmonic telegraph that could transmit several messages simultaneously over the same wire. But one pivotal day, Watson accidentally screwed one of the vibrating reeds on the telegraph too tightly, which created an electrical current. Sitting some distance away, Bell heard a "ping"—and he realized that the sound had been transmitted across wires. He began working on transmitting speech in the same way.

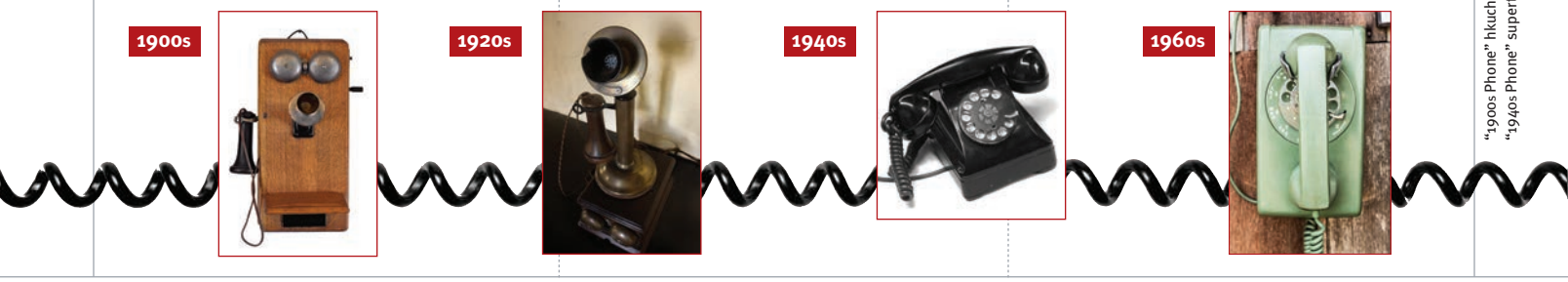
In March 1876, Bell and Watson built a telephone prototype. It consisted of a metal cone with parchment paper stretched across its narrow base. Beneath the parchment paper was a needle, which was pointed at a cup of diluted sulfuric acid; the needle was also wired to a battery. When someone talked into the cone, the parchment paper vibrated, and the needle moved up and down, making continual slight contact with the acid. This movement changed the electrical circuit vibrations, which then traveled along a wire to a receiver, where the original sounds were reproduced. Testing the device one day, Bell said something like, "Mr. Watson, come here, I want you!" Sitting in another room, Watson heard Bell's voice across the wire. The telephone was born.



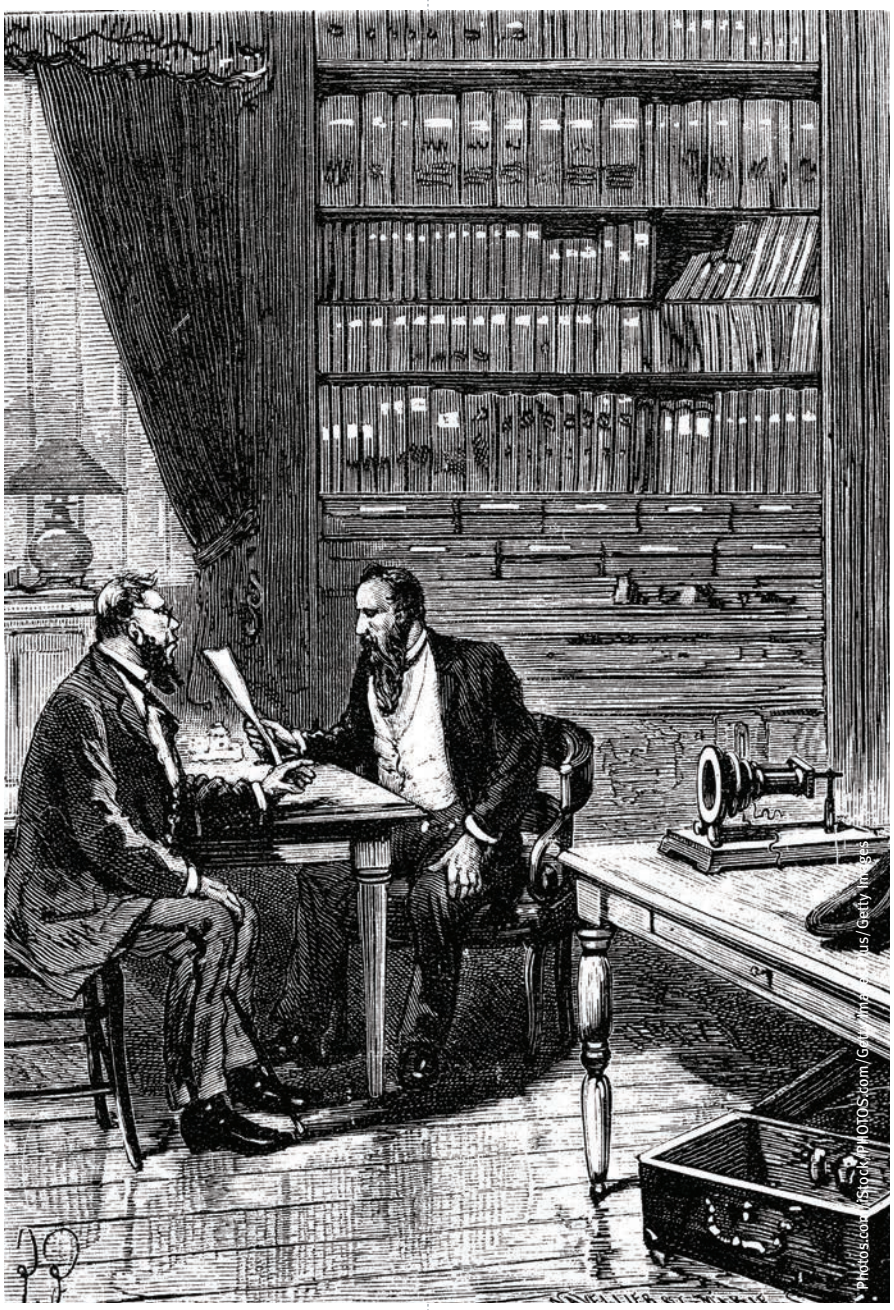
ZU_09/DigitalVision Vectors

Exterior view and cross-section views of the of mouthpiece apparatus of Alexander Graham Bell's first telephone.

VISUAL HISTORY OF THE TELEPHONE



"1900s Phone" hkuchera/iStock/Getty Images Plus/Getty Images; "1920s Phone" Sayarikuna/iStock/Getty Images Plus/Getty Images; "1940s Phone" supertramp/iStock/Getty Images Plus/Getty Images; "1960s Phone" deaw59/iStock/Getty Images Plus/Getty Images



Alexander Graham Bell filing patent paperwork

Of course, it was impractical to rely on a cup of acid to transmit voice waves over more than a short distance. In 1877, Thomas Edison designed and patented a new transmitter; it utilized carbon for much greater capacity (when used in conjunction with outside power) for distance and clarity.

By that same year, Gardiner Hubbard, Bell's father-in-law, had organized a group that established the Bell Telephone Company with the purpose of commercializing the telephone. Machinist Charles Williams was the recipient of the first telephone line, which was installed between his electrical shop and his home a few miles away. Just three years later, Bell Telephone Company, which required customers to lease their telephones, controlled 60,000 of them.

The first phones used a single iron wire to transmit voice waves, just as a telegraph did. But the result was a static-filled exchange, since the wire needed to be grounded in the earth to complete the circuit. Bell found a solution in 1881 with a two-wire system. Creating a complete circuit solved the static problem—and made it necessary to replace all existing telephone lines.

1980s

early 2000s

Present

"1980s Phone" gzaleckas/iStock/Getty Images Plus/Getty Images; "early 2000s Phone" User2547783c_812/iStock/Getty Images Plus/Getty Images; "Smartphone" scanrail/iStock/Getty Images Plus/Getty Images; "Phone cord"

By 1885, Bell Telephone created a subsidiary called the American Telephone and Telegraph Company (the AT&T of today) to operate a long-distance telephone network, with the first line connecting New York and Philadelphia. Within a decade, telephone use really began to explode. In 1894, Bell's patent expired. Over the ensuing years, thousands of phone companies would begin operating in local areas.

Bell and Watson made history again in 1915, this time when they were on the dialing and receiving end of the first transcontinental phone call, which took place between New York and San Francisco.

Today, although 95 percent of Americans now own a cell phone of some kind, these devices work in a similar way to Bell's telephone in that the caller's voice is converted into an electrical signal. The difference? That signal is transmitted via radio waves instead of wires.

In the early days of the telephone, Alexander Graham Bell would face more than 600 lawsuits from others who claimed to have invented the device. But he was the first to build a telephone for the commercial market—and so he is recognized as the one who forever changed the way the people of the world connect with one another.

Alexander Graham Bell at the inauguration of the long-distance telephone line

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