FLYING HIGH

During the 1930s two airborne technologies rivalled each other. Airplanes became sleeker, faster, and more comfortable as the decade progressed. But airships, also known as “dirigibles” and today known as “blimps,” could cover huge distances, staying aloft for sixty or more hours at a time. Both forms of air travel received widespread publicity, though the airplane finally won the hearts of the American public.

“Fixed-wing” aviation—airplanes—received a boost in 1932 when Governor of New York Franklin D. Roosevelt (1882–1945) flew to Chicago to accept the Democratic presidential nomination. Roosevelt’s trip illustrated that air travel could be a useful form of everyday transport. But it was aviators such as Wiley Post (1899–1935) who pushed airplane technology to its limits and won the hearts of Americans. Post flew around the globe in nine days in 1931 and in eight days the following year. In 1938, Howard Hughes (1905–1976) cut the record to four days. A successful businessman, Hughes’s experience would make him a major influence on American commercial airlines in years to come. Flying also gave women the chance to hit the headlines. In 1932, Amelia Earhart (1897–1937) became the first woman to fly solo across the Atlantic. In the following years she set many distance and speed records but disappeared over the Pacific Ocean in 1937 while trying to become the first woman to fly around the world.

Perhaps the greatest American hero of the decade was Charles Lindbergh (1902–1974). In 1927 Lindbergh became the first person to fly solo across the Atlantic. During the Depression, Lindbergh’s heroic exploits were front-page news. He and his plane, the Spirit of St. Louis, became a modern symbol of the pioneering spirit. With his wife, Anne Morrow Lindbergh (1906–2001), he flew many long-distance flights, gathering experience that would make him American Airways’ most valuable adviser.

The National Advisory Committee on Aeronautics (NACA) spent the 1930s advising airplane manufacturers on streamlining and engine development. The airlines wanted bigger, faster, more comfortable machines, such as the ten-passenger Boeing 247. The Douglas Company built its DC-1 to compete with Boeing’s most up-to-date planes. Like the 247, it boasted an all-metal skin and powerful engines. It could carry twelve passengers and first flew in July 1933. But even as the DC-1 was being tested, the decision had been made to turn it into the DC-2, the fastest passenger airliner of its day. A larger version of the DC-2, known as the DC-3, offered
fourteen sleeper berths and could seat twenty-one passengers in its “day version.” The DC-3, known as the “Gooney Bird” because of its curving wings, sold to airlines around the world. It was tough, fast, and reliable. Many DC-3s remain in service in the twenty-first century, making it one of the most successful aircraft ever built.

While fixed-wing airliners were becoming the flying machine of choice, airship technology had also made advances. Rigid airships or “dirigibles” were crafted as huge cigar-shaped structures filled with hydrogen gas that gave lift to a gondola that carried passengers and crew. The main advantage of airships over fixed-wing airplanes is that they can spend days in flight without refueling.

Most airship development in the 1930s went on in Germany. But after the Los Angeles was bought from the Germans by the U.S. Navy, two American airships were planned. The Akron and the Macon cost $8 million each and were built at Akron, Ohio, between March 1930 and August 1931. The Akron was intended as an aircraft carrier. A system of hooks allowed small fixed-wing aircraft to be launched and recovered while in flight. Both the Akron and Macon were destroyed in crashes. The Akron went down in 1933 with the loss of seventy-three lives, while the Macon crashed in the Pacific near San Diego, killing two crew members.

Before long-range airliners began operating in the 1950s, flying boats carried passengers along the trans-ocean routes. The Sikorsky S-42, the Martin Clippers, and the Boeing 314 offered great comfort and style. They were the second most luxurious way to fly in the 1930s. Their advantage was that they needed no special airstrip to take off and land, just a strip of open water, such as a lake.

By far the most luxurious way to fly in the 1930s was by airship. The German airship Hindenberg began a transatlantic service in 1936 and made
The Hoover Dam

Standing 440 miles upstream of the Boulder River’s outflow into the Gulf of California, the Hoover Dam is one of the engineering marvels of the twentieth century. The project was launched by Secretary of the Interior Ray Lyman Wilbur (1875–1949) on September 17, 1930. The dam cost $165 million and was financed by a fifty-year loan from the federal government. It was designed to provide between 1.6 and 1.8 million horsepower of electricity for Arizona, California, Nevada, New Mexico, Utah, and Wyoming. Sixty-five percent of the electricity went to the city of Los Angeles. The building of the dam was a remarkable achievement. Many workers died from heat exhaustion, but it took just four years from construction beginning to the dedication ceremony in 1935. Originally called the Boulder Canyon Dam, it was renamed after President Hoover in 1947. Stories of exhausted workers being entombed in concrete are untrue.

ten round trips in that first season. Passengers enjoyed private cabins, a restaurant, lounge, and even a promenade deck. Because of the risk of fire, smoking was not allowed on board. The service did not last long. In 1937, a build-up of static electricity set fire to the airship’s fabric skin, igniting the hydrogen gas stored inside. The crash of the Hindenberg ended the airship era in the United States.

❖ GETTING PLACES

Transportation in the United States received a great deal of attention during the 1930s. Although bridges, railroads, and roads did not capture the public’s fascination like flying did, they boosted the country in other ways. Some of America’s most famous bridges were completed or built in the 1930s. In 1931, the Rogue River Bridge in Oregon was completed with seven 230-foot spans. The construction of the 3,500-foot George Washington Bridge, suspended with wire cables across the Hudson River between Manhattan and New Jersey, was completed in 1931. Plans for a bridge between San Francisco and Oakland had been around since the 1850s. But the scale of the project was deemed too large. The George Washington Bridge set an example for California to follow, and in 1929 the Transbay Bridge Project began work. The bridge was funded with public money and
supported by President Herbert Hoover (1874–1964). A construction permit was granted on January 19, 1932. The problem of building a bridge over two miles of open water was solved by the decision to build two suspended bridges joined together. The total length came to 8,100 feet at a cost of $79.5 million. The San Francisco/Oakland Bay Bridge opened on November 12, 1936. A year later, on October 1, 1937, the Golden Gate Bridge opened. Its overall length of 9,266 feet makes it one of the longest bridges in the world.

The Depression hit the railroads hard. Passenger numbers fell by almost 30 percent between 1929 and 1932. Railroad companies complained of heavy regulation and local, state, and federal taxation. The amount of freight carried by the railroads also fell as trucks grew bigger and more powerful. Road transport had the advantage of not being taxed. Railroads faced competition from oil companies transporting oil by pipelines and from airplanes. Airplanes carried 327,211 passengers in 1930, and the number increased in every following year.
Railroad companies responded to their difficulties by modernizing. Lines were electrified, and companies such as the Baltimore and Ohio brought in the “refrigerated principle,” air conditioning whole trains by the late 1930s. On the Minneapolis to Chicago line the Zephyr Streamliner set new standards in speed and reliability. It was on time even in the depths of winter and could average eighty miles an hour. Over long distances rail could compete with trucking. The railroad companies improved the pickup and delivery systems at their freight yards. Improving the relationship between rail and road transportation became an important goal of President Franklin D. Roosevelt’s New Deal. Roosevelt (1882–1945) signed the Railroad Reorganization Bill on June 16, 1933.

In 1930 there were 325,000 miles of state and federal roads. But only two-thirds of that distance was surfaced. This placed severe restrictions on road transport, especially for long-distance trucks. The National Industrial Recovery Act (NIRA) allowed the federal government to organize the unemployed into work parties to repair and resurface the roads. New parkways and turnpikes were built to carry the increasing volume of road traffic. More than half a million unemployed men were put to work building roads in the 1930s.

CHEMISTRY INFLUENCES AMERICAN SCIENCE

By the end of the 1930s, chemistry was a major discipline in American science. In 1930, American universities awarded 332 Ph.D.s in chemistry. In 1939, that number was 532. American chemists won several important awards in the 1930s, and the number of industrial laboratories grew. Between 1928 and 1938, Dow Chemical increased the number of its research workers from 100 to 500.

An increase in researchers led to an increase in new discoveries. For example, discoveries were made during the 1930s about the chemical elements that make up the basic building blocks of the universe. The “periodic table,” devised in 1869, lists these elements according to their “atomic number.” By 2001, there were 103 known elements, but in the 1930s only 92 were known, and numbers 61, 85, and 87 were missing. Marguerite Perey (1909–1975) discovered number 87 in 1939, naming it Francium after her native France. In 1935, Jeffrey Dempster (1886–1950) discovered that the element uranium occasionally appeared in a different form or “isotope” called uranium-235. This is the substance used in the atomic bomb.

Perhaps one of the most important advances in chemistry during the 1930s was the commercial production of vitamins. The existence of vitamins had been verified in the 1900s. But nothing was known about their
Refrigerators

Refrigerators had been around since the 1920s, but they only became widespread after 1930. One reason was that most homes outside of major cities did not have electricity. But early refrigerators were rather dangerous. In 1930 Thomas Midgley (1899–1944) managed to create Freon, an odorless gas that was thought to be safe. More than a million refrigerators were sold in 1930, over three quarters for household kitchens. Americans spent more than $220 million on refrigerators that year. By 1931, 14.7 percent of American homes had a refrigerator. Most of them were in urban areas.

Chemical research also became crucial to American industry during the 1930s. The chemical company DuPont introduced “duprene,” a synthetic rubber, in 1931. The new material had several advantages over natural rubber. Duprene did not degrade when exposed to air, kerosene, or gasoline. It was also very easy to make and mold into shape. Renamed “Neoprene,” Dupont’s synthetic rubber went on sale in 1937. Along with other plastics and synthetic rubbers, it had a dramatic effect. Synthetics replaced natural rubber in everything from car tires to condoms.

An even more significant achievement was the development of nylon. First conceived by DuPont as an alternative to silk, nylon had many other uses. It was first sold as toothbrush bristles in 1938. DuPont also set up a plant to produce nylon stockings, and by March 1939, more than five thousand pairs had been sold. Nylon turned out to be one of the most important developments in industrial chemistry. In the twenty-first century it is used in thousands of products, from bicycle tires to waterproof
clothi ng and kitchen utensils. And more than sixty years later, toothbrush bristles are still made from nylon.

❖ RUDIMENTARY GENETIC SCIENCE

In the 1930s, genetics research was at the forefront of the biological sciences. The main question of the time was: how does a fixed set of genes produce such a huge variety of differences in a species? Two schools of thought existed. The German biologist August Weismann (1834–1914) studied the idea that certain traits were dominant and others “recessive.” Recessive traits would only come to the fore when dominant traits were absent. Hugo de Vries (1848–1935) took a different approach. He investigated gene mutation. But genetics research was slow until the 1950s, when microscopes were developed that were powerful enough to provide a closer look.

In the absence of sophisticated physical evidence about genetics, socially influenced theories about the biology of the human race persisted during the decade. The idea behind the science of eugenics is that the hereditary qualities of a species can be improved through selective breeding. The idea that certain races were superior to others had a strong following in the United States in the 1930s, as did it in Germany during the same time period. Members of the eugenics movement, which was more political and social than scientific in nature, argued that “inferior” human races should be prevented from reproducing in order to control their numbers. Eugenicists believed that pure racial stock could be “contaminated” by inferior racial stock. Many states had laws against interracial marriage in an effort to prevent the birth of racially “mixed” children. Twenty-seven states had laws making it legal for “inferior” people to be sterilized to prevent them from having children. The law was mostly applied to those in mental hospitals and prisons. In 1934 an article in the Scientific American argued that the case for population control had not been proved. But it also called one-fifth of the U.S. population “surplus,” fueling eugenicists’ arguments that society could not afford to support “inferior” people who could not support or care for themselves.

The American Eugenics Society (AES) had been founded in 1926. It reached its peak membership in 1930, with about 1,250 members. American eugenicists and sterilization laws were praised by Nazi Germany during the early years of the decade. In return, some white Americans believed that the shadowy Nazi practice of sterilizing Jews could provide an acceptable model for dealing with the African American population in the United States. By the mid-1930s, the eugenics movement was declining in political favor. The AES began to distance itself from the Nazis when news of the mass murder of Jews came to light late in the decade. By then the term
“eugenics” was associated with brutality and violence. As genetics research developed over the next two decades and beyond, many of the myths of the eugenics movement were exposed as having no basis in scientific evidence.

**EARTHY STUDIES**

In the 1930s differing theories about Earth’s history highlighted the field of earth sciences. In 1912, German geologist Alfred Wegener (1880–1930) had proposed the idea that the continents had once been joined together. Wegener suggested that the continents were riding on huge tectonic plates that had drifted apart over the years. Evidence for his idea was found in the 1930s. Rock formations in South America and South Africa suggested that the two continents had once been linked, and the remains of similar prehistoric animals on both sides of the Atlantic also supported his idea. But despite the growing body of evidence, many scientists in the 1930s still opposed the idea of continental drift.

The movement of the earth intrigued other scientists in different ways. In 1935 Charles Richter (1900–1985) and Beno Gutenberg (1889–1960) developed a scale for measuring the strength of earthquakes. Working at the California Institute of Technology in Pasadena, Richter and Gutenberg used machines known as seismographs to measure vibrations and plot them on a graph. The scale measures the distances of a graphed line from the centerline. Although seismologists began to use the scale in the 1930s to evaluate earthquake strength, it was another twenty years before the scale was recognized or understood by the general public. Richter never used the term “Richter Scale,” as it is known today, because
he considered Gutenberg to be equally responsible for its development. Instead he called it “that confounded scale.”

The study of Earth’s weather, or meteorology, demonstrated great advances in the quantity and accuracy of information gathering during the 1930s. One of the key techniques for studying the weather in the 1930s was a device known as a radiosonde. Developed in Norway, a radiosonde is a radio transmitter suspended below a large, gas-filled balloon. It measures air pressure, wind speed, humidity, and temperature high up in the atmosphere. The information is transmitted back to base stations on the ground. From this information, 1930s meteorologists drew diagrams of weather patterns as they developed. These diagrams began to be collected on a daily basis in 1934. Other developments in the 1930s included “dynamic climatology.” This was the study of air masses and weather fronts that tried to explain why rain clouds formed. In all, the world around us became much more understood thanks to the scientific advances of the 1930s.

**PHYSICS AND THE ATOMIC AGE**

Like the other sciences, American physics benefited in the 1930s by scientists fleeing from dictatorships in Europe. Physicists from Europe and the United States worked together to make many important discoveries. These discoveries broadened our understanding of the world around us, but were not easily understood by many people. One of the most important inventions was Ernest Lawrence’s (1901–1958) cyclotron, a machine that could separate particles from atoms. The cyclotron is the forebear of the huge, circular, particle accelerators used in the twenty-first century.

English physicist James Chadwick (1891–1974) discovered the neutron in 1932. Neutrons are particles inside atoms. Astrophysicist Carl David Anderson (1905–1991) identified the first antiparticle, known as the positron. Working with Seth Neddermayer (1907–1988) in 1937 Anderson also discovered the muon, another subatomic particle. Astronomer Edwin Powell Hubble (1889–1953) devised a method for working out the age of the universe and calculated that it was two billion years old. In 1939, the German physicist Hans Bethe (1906–) discovered that “stellar energy” detected in space was the result of nuclear reactions. From this he was able to calculate that the temperature at the center of the Sun is 18.5 million degrees Kelvin, or 333 million degrees Fahrenheit.

Research about subatomic particles led to some potentially devastating discoveries. German and Swedish scientists, Otto Hahn (1879–1968),
Lise Meitner (1878–1968), and Fritz Strassmann (1902–1980) found that by bombarding a form of uranium with neutrons, a huge amount of energy could be released. Hahn, Meitner, and Strassmann made their discovery in 1938, but the process of nuclear fission was first made public in
Scientific Terms

- **Antiparticle**: A subatomic particle that corresponds to a similar subatomic particle with the opposite electric charge. For example, an antineutron is the antiparticle to the neutron.

- **Atom**: The smallest particle of an element. Atoms are made up of protons, electrons, and neutrons. When the number of negative electrons and positive protons is the same, the atom is stable because they cancel each other out; the bigger the difference between the numbers of electrons and protons, the more unstable the atom will be.

- **Atomic number**: The number of protons in the nucleus (core) of an atom; in the periodic table, the elements are arranged in order of their atomic number.

- **Electron**: Part of an atom; Electrons have a negative charge.

- **Elements**: Substances that cannot be broken down into other substances (examples are oxygen, hydrogen, and zinc); around ninety elements occur in nature; since the 1930s thirty more elements have been formed via nuclear reactions.

- **Genes**: The units containing the information needed to make a living organism.

- **Isotope**: An atom of an element that contains the same number of protons but different numbers of neutrons; isotopes are given a number after their name.

- **Periodic table**: A table listing the chemical elements in order of their atomic number; it was devised in 1869 by Dmitri Mendeleyev (1834–1907).

- **Proton**: Part of an atom; protons have a positive charge.

- **Synthesize**: To make a substance artificially rather than collect it from nature; synthetic rubber is made in factories and natural rubber is collected from rubber trees.

1939 by Niels Bohr (1885–1962) at the American Physical Society in New York. What Bohr described in his address was the invention of the atomic bomb. Afraid that Nazi Germany would develop a useable atomic bomb first, American scientists persuaded Albert Einstein (1879–1955) to write President Franklin D. Roosevelt (1882–1945) requesting money for research into the bomb. Einstein was a well-known pacifist and
opposed to violence of all kinds, but he wrote the letter on August 2, 1939. The development of the atomic bomb would alter many people’s ideas about war and life forever.

**TELEVISION’S FIRST TRANSMISSIONS**

In 1931, several experiments were made with television broadcasting. Although the transmissions were available to the public, no private individuals had televisions to receive them. The Jenkins Television Corporation in New York City set up a five thousand–watt transmitter to broadcast television pictures, but no sound. The idea was that the WGBS radio station on Long Island would broadcast sound at exactly the same time. The receiver would pick up pictures and sound simultaneously. Not surprisingly, there were many problems. Televised pictures in 1931 were dark, shadowy, and unclear—far worse than the first movie pictures had been thirty years earlier.

By 1935, RCA (owner of NBC) was ready to spend a million dollars on TV broadcasting, using the Empire State Building as its transmitter. Two years later a new camera called an iconoscope dramatically improved picture quality. Experimental broadcasts were made, with technical standards improving all the time. In 1938, NBC was able to use a mobile TV unit to interview passersby on Rockefeller Plaza. On September 30, 1939, President Franklin D. Roosevelt (1882–1945) made the first ever televised address by an American president when he broadcast live from the New York World’s Fair. But with early televisions costing a minimum of two hundred dollars, few Americans could afford to watch.

It was often difficult to find a clear signal on AM radio. Several inventors in the 1930s were looking for an alternative. The most significant of these was Edwin H. Armstrong (1890–1954). Between 1930 and 1933 he filed four patents for frequency modulation (FM). Working with RCA, Armstrong tested FM radio using the antenna on the top of the Empire State Building. Although FM was used by the military in during World War II, it wasn’t until the 1950s that it took off commercially.