NASA uses a DC-8 as a flying science laboratory.
“Flying has torn apart the relationship of space and time; it uses our old clock but with new yardsticks.”

Charles Lindbergh
Howard R. Hughes Jr., son of a Texas oilman, was born in 1905. Young Hughes learned to fly at age 14. He quickly became a skilled pilot. When his father died, Howard Jr. inherited the family business, Hughes Toolco. He was a millionaire before he was out of his teens. He soon expanded Toolco to include a division called Hughes Aircraft. He also gained fame as a pilot, setting many records for speed and distance.

In 1939 Hughes became the principal stockholder of Transcontinental and Western Air (TWA—later known as Trans World Airlines). A stockholder is a person who owns shares of a public company. This gave Hughes a voice in running the airline.

TWA had a fleet of state-of-the-art Boeings. They attracted attention—and passengers. They could fly coast to coast in 14 hours. But that wasn’t fast enough for Hughes. He wanted a new type of plane.

When Howard Hughes needed a new plane for TWA, why did he turn to Lockheed?
But TWA couldn’t build it. New antitrust laws—laws intended to prevent concentrations of power in business—now kept TWA and other airlines from building their own planes. Hughes had to look elsewhere. He turned to Lockheed, a company he’d worked with before.

Hughes told the designers that he wanted a really fast passenger plane. So they chose a different type of engine, an 18-cylinder Wright R-3350. The plane’s propellers were more than 15 feet in diameter. To enable the props to clear the ground, the plane needed very tall landing-gear struts, or braces. For better control, the plane needed a large tail surface. That led to a distinctive triple-fin tail design.

Hughes demanded that his new plane be built under strict secrecy. He got his wish until World War II. At that point, the government took over commercial planes for wartime service. The secret project was out in the open.

The new plane was the L-049 Constellation. Although designed for passengers, it was first used as a military plane (the Lockheed C-69 Constellation). The L-049 flew faster than the fighter planes of its day.

When the Constellation was ready for a test flight in 1944, Hughes was at the controls. The new plane, painted in TWA’s distinctive red, flew nonstop across the country in less than seven hours. Hughes broke his own speed record with that flight.

TWA wasn’t ready to offer regular nonstop cross-country service. But the Constellation cut about eight hours off the trip from coast to coast.

The Constellation and its counterparts from Douglas Aircraft, the DC-6 and DC-7, were the stars of air travel during the 1940s and 1950s. They were the fastest, safest, and most comfortable propeller-driven airliners ever built. Until the passenger jet came along in the late 1950s, they were the highpoint of air travel.
Howard Hughes—Moviemaker and Aviator

Howard Hughes Jr. (1905–1976) learned to fly in his early teens. But before earning fame in aviation, he was a well-known movie director and producer. One of his movies was a World War I epic called “Hell’s Angels.” He wrote and directed it himself. Filming began in 1928. He got 87 combat planes together and directed combat scenes in the skies over Mines Field. (The Los Angeles International Airport is there now.)

Years later, Hughes made another war movie, “Jet Pilot,” starring John Wayne. Hughes started filming in 1949 but didn’t release the movie until 1957. He kept tinkering with the combat scenes to get them just right. This was long before the days of computer-generated special effects. He needed real planes for his action scenes.

The Air Force was grateful for Hughes’s pioneering work in aviation. So it let him use military planes.

Hughes’s movie included a scene with superstar pilot Chuck Yeager at the controls of a Sabre jet. It also showed Northrop’s XF-89 Scorpion prototype which appeared as a Russian fighter plane.

But Hughes is better known for another case of cooperation with the US armed forces. In 1942 German submarines were sinking US troop transports. Shipbuilder Henry Kaiser had an idea—why not build a fleet of flying boats? They would be made of wood because of a wartime shortage of metal.

Key Developments in Commercial Aircraft

As you read in Chapter 4, air power helped the Allies win World War II. The war also exposed millions of Americans to aviation, often for the first time. More than 2 million Americans worked in the aircraft industry in the 1940s. More than 16 million served in uniform and saw air power firsthand. Hundreds of thousands of them flew for the first time during the war.

After the war, interest in aviation was keen. People who wanted to start airlines could buy military-surplus planes at bargain prices. Many people wanted to work in the field. Many more now saw air travel as a great way to get across a vast country. Americans were ready to fly.
When Kaiser got an $18 million government contract, Hughes signed on. The partnership didn’t last long. Things didn’t move fast enough for Kaiser. And so he pulled out.

Hughes renamed the aircraft the H-4 Hercules. But most people called it the “Spruce Goose” because of its wooden frame. Hughes hated the nickname. For one reason, the H-4 was made of birch, not spruce. He also thought the nickname belittled a good design and the workers who’d built it.

The H-4 was eventually the world’s largest flying boat. Hughes flew it once for 60 seconds. It never flew again. It still holds the record for the largest wingspan in aviation history: 319 feet, 11 inches.

As time passed, Hughes became more and more isolated and eccentric. Some people think he may have been mentally ill. The man who was once a public figure lived his final years in seclusion.

The war did more for aviation than just make people aware of it. It also spurred many technical advances. New kinds of planes came into use. New airports appeared around the world. Weather forecasting got better. Navigation aids improved. These things made flying safer. Better fuel—100-octane aviation gas—gave aircraft engines more power. This meant planes could carry heavier loads and fly farther.

Radar, which helped the British keep an eye out for German bombers during the war, came into use in civil aviation, making air travel safer. And pressurized cabins—cabins with normal air pressure even at high altitudes—made air travel more comfortable.
No matter how strong or large their planes, people who flew in the early days had one big problem: flying could literally make you sick. One reason was that there wasn’t enough oxygen in the cabins.

The higher you go above sea level, the less oxygen is in the air. Mountain climbers deal with this problem all the time. If planes flew much higher than 10,000 feet in the early days, people on board got dizzy. Some even fainted.

One solution might be to fly low. But below 10,000 feet, planes often hit rough weather. That led to airsickness—motion sickness associated with flying. Airlines knew if they could make passengers more comfortable, more people would want to fly.

The big breakthrough was the Boeing 307B Stratoliner. It made its first flight 8 July 1940. It had a pressurized cabin. As the plane rose, air was pumped into the cabin. Even well above 10,000 feet, air pressure inside the cabin was the same as it is on the ground.

The 33-seat Stratoliner could fly at an altitude of up to 20,000 feet. It reached speeds as great as 200 miles per hour.

**BOEING 307 STRATOLINER**
The Boeing 307 Stratoliner took air travel comfort to new heights.

Courtesy of the National Air and Space Museum, Smithsonian Institution
(SI Neg. No. SI-2007-4592)
Important Commercial Aircraft

The DC-3 (See Chapter 3, Lesson 3) was the most widely used aircraft right after the war. But before long the airlines wanted to fly longer routes. They also wanted to carry heavier traffic. They turned to the civilian versions of two planes that first saw service in the war.

The four-engine Douglas DC-4 was the civilian version of the C-54. And as you read earlier, the Lockheed Constellation started out as the C-69.

The Constellation had a pressurized cabin, so it could fly higher. It could also fly about 100 miles an hour faster than the DC-4. But the DC-4 won the first round of competition between the two. One reason is that DC-4s were easier to come by. More than 1,000 of them were built during the war. Soon almost every airline was flying DC-4s.

But when the supply of surplus DC-4s ran out, the Constellation became the top seller.

Meanwhile, Douglas and Lockheed kept developing bigger and better planes. Douglas had the DC-6, the DC-6B, DC-7, DC-7B, and DC-7C. The DC-7C was known as the “Seven Seas” because of its great range.
Not to be outdone, Lockheed developed the Super Constellation and the Starliner. These planes eventually had 100 seats. They flew at around 300 mph. They could cross the country nonstop in nine hours or less. They could also fly from New York to London.

By 1947 airlines flying shorter routes could choose between the Martin 2-0-2 and the Convair 240. These planes were faster than the DC-3. They were pressurized. They offered the same passenger comforts as the DC-6 and Constellation did.

Another development at this period was the rise of all-cargo airlines—airlines that carried freight, not passengers. Like early passenger planes, the first all-cargo planes were developed for the military. They included C-47s and C-69s.
Donald Wills Douglas Sr.—Aviation Pioneer

Donald Wills Douglas Sr. (1892–1981) was born in Brooklyn, New York. He entered the US Naval Academy at Annapolis, Maryland, at 17. He spent much of his time there working on model planes. His family and professors thought this interest would pass. But Douglas was hooked on planes. He left the academy before graduation to look for work as an aeronautical engineer.

Douglas enrolled in the Massachusetts Institute of Technology. He finished a four-year course in two years. The school offered him a job as assistant professor immediately.

After that, he lived in Connecticut, California, and Ohio. He served briefly as a civilian in the Army Signal Corps Aviation Section in Washington, D.C.

But Douglas’s goal was to make it on his own in the aircraft business. In March 1920 he returned to Los Angeles, with $600 and a family to support. He hoed potatoes and washed cars to provide for his family.

And then he got his first aircraft order. It was from millionaire sportsman David R. Davis. They got together and formed the Davis-Douglas Co. The company built the Cloudster. It was the first aircraft to lift a useful load exceeding its own weight.

Davis soon lost interest in the company. He sold out to Douglas, who incorporated the Douglas Company in July 1921. Douglas landed his own Navy contract—to build torpedo bombers, starting with the DT-1. By 1928, the company was worth $25 million.

Douglas kept going through the Great Depression by building military aircraft. Soon after, he started building his famous airliners. By 1940 sales of DC-2 and DC-3 aircraft reached nearly $61 million.

Douglas remained president of his company until 1957.
Between the world wars, another kind of aircraft had a moment of glory. This was the rigid airship, or zeppelin. (Airships were a type of lighter-than-air flying machine you read about in Chapter 1.)

The German maker Zeppelin was the most successful builder of airships. The Germans used them during World War I. At the end of the war, they had to surrender their airship fleet to the Allies. According to terms of the Treaty of Versailles, the Germans could no longer build military aircraft.

But by 1926 the Germans could once more build zeppelins. One of them, the Graf Zeppelin, flew more than a million miles, made 590 flights, and carried more than 13,000 passengers before it was retired.

But the most famous zeppelin was the Hindenburg. It was the largest and most luxurious airship ever built. It made 10 round trips between Germany and the United States. But on 6 May 1937, as it prepared to land in New Jersey, it exploded, crashed, and burned. Thirty-five passengers and crew members died. They were the first fatalities in scheduled airship operations.

The US Navy also flew airships. In 1923 it built the Shenandoah. It was a flying public relations machine. It flew around the country visiting air shows and county fairs.

On 3 September 1925, however, the Shenandoah was caught in a storm over southern Ohio. It broke up. Part of the airship landed in a cornfield. Lt Cmdr Charles E. Rosendahl brought the nose section to a safe landing. But 14 of the 43 crew members died.

Later, Goodyear Tire and Rubber Company won a contract to build zeppelins in the United States. It built two airships for the Navy—the Akron and the Macon.

Both met with disaster. The Akron crashed off the New Jersey coast in 1933, killing 73. The Macon plunged into the Pacific Ocean in 1935. Fortunately, Navy ships nearby saved all but two of the 83 on board.

After these accidents, the United States lost interest in airships. The Hindenburg disaster marked the end of efforts to use airships for commercial travel.
Key Developments in Commercial Flight Use

Many features of air travel today had their roots in these early years. Among them were flight attendants, frequent-flier discount programs, travel credit cards, and airline agents who could reissue tickets after a missed connection or a delayed flight. The airlines even offered a telephone reservation service.

Growth of Commercial Flight Use

The 1930s were a time of enormous growth in passenger air travel. The number of air passengers in the United States rose from 474,000 in 1932 to 1,176,858 in 1938. The number of air-passenger miles increased 600 percent between 1936 and 1941. The DC-3 was responsible for much of this growth. Still, long-distance travel was mostly by rail.

TWA began the first cross-country passenger air service between New York and Los Angeles on 25 October 1930.

The first regular passenger and airmail service across the Atlantic began 20 May 1939. But as you read earlier, that was seaplane service—Pan American’s “flying boats.”

In October 1945 an American Airlines plane took off from New York and touched down at Hurn Airfield in England. This was the first commercial flight by a land-based plane from North America to Europe.

Development of Federal Regulation of Commercial Flight

In 1938 a new federal agency, the Civil Aeronautics Authority, took charge of civil aviation. It set airfares. It also set airlines’ routes.

In 1940 President Franklin Roosevelt split this agency in two. Both new agencies were part of the Department of Commerce.

Roosevelt put one new agency, the Civil Aeronautics Administration (CAA) in charge of air traffic control—the ground-based system for keeping aircraft safely separated from one another. The CAA licensed pilots and planes. It enforced safety rules. It also developed airways, the routes that planes must follow through the sky.

Eventually CAA air traffic controllers would take over responsibility for takeoffs and landings at airports. After the war, radar helped CAA controllers keep up with the airline boom. In 1946 Congress gave the CAA the task of promoting development of the nation’s civil airports.

The second agency, the Civil Aeronautics Board (CAB) made safety rules. When an accident occurred, the CAB tried to find out what happened. The CAB also regulated airlines as businesses.
Key Contributors to the Expansion of Commercial Flight

Aviation progressed during this period because leaders of the major airlines were competing with each other for passengers. The companies’ executives demanded more and more of aircraft manufacturers. This led to more competition among manufacturers vying with one another for contracts.

Major Commercial Airlines

Four airlines dominated this period—American, Eastern, TWA, and United.

American Airlines

American Airlines grew from several companies launched in the 1920s to fly airmail. These companies joined to form the Aviation Corporation. AVCO, as it was called, quickly bought several small airlines.

In 1930, to streamline its operation, the company’s board of directors voted to form a new company, American Airways. In 1934 the company’s name became American Airlines.

The company’s new president, Cyrus R. Smith, wanted a new plane to match his vision. American flew 18-passenger Curtiss Condors at that time. Smith wanted something bigger. He worked out a deal with Douglas Aircraft to build 20 DC-3s. The DC-3 became one of the most successful aircraft ever built. By 1939 American was flying more passenger miles than any other domestic airline.

Smith retired in 1968. He was a true pioneer of commercial flight.

Eastern Air Transport

Clement Keys, a former editor at The Wall Street Journal, promoted commercial aviation in the 1920s and 1930s. He eventually bought a small Philadelphia airline called Pitcairn Aviation.

Eddie Rickenbacker, the World War I ace, was Eastern’s general manager. Later he and some associates bought the airline from Keys and his investors.

**Transcontinental and Western Air Inc. (TWA)**

TWA, like Eastern, had a connection with Clement Keys. Also like other major airlines, TWA started out carrying mail. Keys and other investors launched Transcontinental Air Transport (TAT) in 1928 to carry mail. But he thought the time was right for air-passerger travel. He offered a coast-to-coast service combining air and rail. Passengers rode in Pullman sleepers at night. By day, they flew in Ford Trimotors. But even with the support of Charles Lindbergh, the service lost money.

TAT merged with Western Air Express in July 1930 to form Transcontinental and Western Air, Inc. (TWA). TWA received its first mail contract immediately. It began coast-to-coast flights on 25 October 1930. The planes made overnight stops in Kansas City.
Like many other airlines, TWA attracted strong and colorful personalities. Its first director of operations was William John Frye (1904–1959), a former Hollywood stunt flier.

One day when Frye was a teenager, three Army Curtis Jennies (See Chapter 3, Lesson 1) made emergency landings near a pond where he was ice skating. He forgot his skates to go help the fliers. By the end of the day he’d picked up pneumonia and a fascination with flight. He recovered from the first. The second stayed with him the rest of his life.

He became president of TWA at age 30. A licensed pilot, Frye kept TWA on the leading edge of technical advances. He helped set the specifications for the Douglas DC-1 and DC-2 as well as other planes.

When Frye wanted 33 Boeing Stratoliners built in 1938, he convinced a quirky millionaire named Howard Hughes to finance the deal. He later persuaded Hughes to buy a controlling interest in TWA.

**United Airlines**

United Airlines began as part of the United Aircraft and Transport Corporation. This was a partnership between Boeing Airplane Company and Pratt and Whitney, the engine maker. United Airlines began as an operating division of the partnership on 1 July 1931. It advertised itself as the “world’s largest air transport system.”

New antitrust legislation soon required Boeing to sell the company off. But United remained important. On 30 March 1933 it introduced the Boeing 247 (See Chapter 3, Lesson 3). Many people call this the world’s first modern passenger plane. Soon United was flying coast to coast in a little less than 20 hours.
Other Developments in Commercial Airlines Operations

Transatlantic Service

From the time commercial aviation began, fliers dreamed of connecting North America and Europe.

It was a real challenge. North Atlantic skies are often stormy. Natural stopping places are few. Partly for that reason, some of the first transatlantic services crossed the South Atlantic. These routes connected West Africa and South America.

British Imperial Airways and Pan American Airways tried out transatlantic service in 1936. Before then, the British hesitated to give Americans landing rights.

In June 1945 the CAB allowed three carriers to operate regular air service across the Atlantic. They were American Export, Pan Am, and TWA.

That ended Pan Am’s role as the sole US carrier. It also led to a boom in air travel.

Freight Airlines

In November 1910 a department store in Dayton, Ohio, shipped a bolt of silk by air to Columbus, Ohio—a distance of less than 100 miles. This was the first practical demonstration of freight shipping by air. Even for short routes, air express was already faster than the railroad.

But all-cargo airlines didn't emerge until after World War II. Companies found it hard to get into the cargo business. Passenger airlines tried to keep them out of airports. Passenger lines feared that freight carriers would upset the aviation industry with cheap rates and irregular service. Through the 1940s passenger airlines, freight carriers, and the government regulators struggled for a solution. They needed to find a way to award contracts and set rates.

In August 1949 the CAB gave four all-freight airlines the go-ahead. They were Slick, Flying Tiger, U.S. Airlines, and Airnews. Only Slick and Flying Tiger lasted through the propeller era of aviation.

Freight airlines never grew as expected. They accounted for only a small share of air cargo. The big four passenger carriers and other passenger lines continued to carry freight. The passenger carriers had better facilities at airports and lower costs.

Not until 1973, when Fred Smith launched Federal Express, with a guarantee of overnight delivery, did an all-freight carrier come into its own.

Throughout the 1950s manufacturers worked on the jet aircraft that would eventually replace planes such as the Lockheed Constellation. On 2 May 1952 the world’s first jet airliner, the British-made De Havilland Comet, made its first public demonstration flight in London. On 4 October 1958 a British Comet IV with 31 passengers made the first transatlantic commercial jet flight. On 10 December 1958 National Air Lines began the first jet passenger service in the United States. The aircraft was a Boeing 707. It flew between New York City and Miami, Florida.

The propeller era had ended. The jet age had begun.
The Taylor E-2 Cub made its first flight on 10 September 1930. This plane led to the famous Piper Cub. It came out in 1938. The Piper Cub was one of the world’s most popular general aviation planes. **General aviation** is all civil aviation other than flights by scheduled airlines and government agencies.

During the early 1930s the US government tried to get ordinary people to buy planes. It even came up with a plan for a “poor man’s plane,” to sell for $700. That would be about $10,000 in today’s dollars.

But manufacturers thought that price was too low. The government’s idea fell through.

In the 1940s general aviation was part of the war effort. The Civil Air Patrol, begun in 1941, trained men as military pilots. Manufacturers built small planes for use in military training and as observation aircraft.

After the war thousands of former military pilots wanted to keep flying. So they bought small planes. Thousands of other veterans learned to fly with government help.

Surplus aircraft were widely available after the war. But manufacturers soon started bringing out new planes as well.

In 1946 Cessna Aircraft launched its C-120 and C-140. Both planes were all-metal high-wing monoplanes. Both were very successful. They led to the Cessna 150/152 and the Cessna 182.

Piper continued its Cub series with the PA-28 Super Cub.

In 1947 Beech, the third of the “big three” manufacturers, introduced the Bonanza. It was an all-metal low-wing craft with retractable landing gear. It could fly at 200 mph, at night, and in all kinds of weather.

The Bonanza was as close as the public could get to a “fighter” plane. Beech had 500 orders for the Bonanza before the plane made its first flight.
Using complete sentences, answer the following questions on a sheet of paper.

1. Why did the Air Force give Howard Hughes help with his movie “Jet Pilot”?
2. Why did Hughes hate the nickname “Spruce Goose”?
3. How did pressurized cabins make it easier for people wanting to fly?
4. Why did the DC-4 win the first round of competition against the Constellation?
5. What was the Cloudster’s claim to fame?
6. Why did the United States lose interest in zeppelins?
7. Which four airlines dominated the postwar propeller era?
8. What coast-to-coast service did TAT offer unsuccessfully?
9. Why was it a challenge for early fliers to cross the North Atlantic Ocean at first?
10. Why did freight airlines not grow as expected?

Applying Your Learning

11. How did World War II make Americans more aware of aviation? How might things have been different had there been no war?