MONETARY SYSTEM

I SHOULD REMIND YOU THAT THESE ARTICLES ARE NOT TO BE USED AS THE ONLY BASIS FOR PREPARING FOR THE ENGLISH EXAM, BUT AS AN EXPLANATORY/ADDITIONAL MATERIAL

Money, any medium of exchange that is widely accepted in payment for goods and services and in settlement of debts. Money also serves as a standard of value for measuring the relative worth of different goods and services. The number of units of money required to buy a commodity is the price of the commodity. The monetary unit chosen as a measure of value need not, however, be used widely, or even at all, as a medium of exchange. During the colonial period in America, for example, Spanish currency was an important medium of exchange, while the British pound served as the standard of value.

Money and the Economy

The functions of money as a medium of exchange and a measure of value greatly facilitate the exchange of goods and services and the specialization of production. Without the use of money, trade would be reduced to barter, or the direct exchange of one commodity for another; this was the means used by primitive peoples, and barter is still practiced in some parts of the world. In a barter economy, a person having something to trade must find another who wants it and has something acceptable to offer in exchange. In a money economy, the owner of a commodity may sell it for money, which is acceptable in payment for goods, thus avoiding the time and effort that would be required to find someone who could make an acceptable trade. Money may thus be regarded as a keystone of modern economic life.

Types of Money

The most important types of money are commodity money, credit money, and fiat money. The value of commodity money is about equal to the value of the material contained in it. The principal materials used for this type of money have been gold, silver, and copper. In ancient time, various articles made of these metals, as well as of iron and bronze, were used as money, while among primitive peoples such commodities as shells, beads, elephant tusks, furs, skins, and livestock served as mediums of exchange. The gold coins that circulated in the United States before 1933 were examples of commodity money. Credit money is paper backed by promises by the issuer, whether a government or a bank, to pay an equivalent value in the standard monetary metal. Paper money that is not redeemable in any other type of money and the value of which is fixed merely by government edict is known as fiat money. In the past, fiat money generally consisted of repudiated credit money, such as the U.S. note known as the greenback, which was issued during the

American Civil War. Most minor coins in circulation are also a form of fiat money, because the value of the material of which they are made is usually less than their value as money.

Both the fiat and credit forms of money are generally made acceptable through a government decree that all creditors must take the money in settlement of debts; the money is then referred to as legal tender. If the supply of paper money is not excessive in relation to the needs of trade and industry and the people feel confident that this situation will continue, the currency is likely to be generally acceptable and to be relatively stable in value. If, however, such currency is issued in excessively large volume in order to finance government needs, confidence is destroyed and it rapidly loses value. Such depreciation of the currency is often followed by formal devaluation, or reduction of the official value of the currency, by governmental decree.

Monetary Standards

The basic money of a country, into which other forms of money may be converted and which determines the value of other kinds of money, is called the money of redemption or standard money. The monetary standard of a nation refers to the type of standard money used in the monetary system. Modern standards have been either commodity standards, in which either gold or silver has been chiefly used as standard money, or fiat standards, consisting of inconvertible currency paper units. The principal types of gold standard are the gold-coin standard, the standard in the United States until 1933; the gold-bullion standard consisting of a specified quantity of gold; and the gold-exchange standard, under which the currency is convertible into the currency of some other country on the gold standard. The gold-bullion standard was used in Great Britain from 1925 to 1931, while a number of Latin American countries have used the dollar-exchange standard. Silver standards have been used in modern times chiefly in the Orient. Also, a bimetallic standard (*see* Bimetallism) has been used in some countries, under which either gold or silver coins were the standard currency. Such systems were rarely successful, largely because of Gresham's law, which describes the tendency for cheaper money to drive more valuable money out of circulation.

Most monetary systems of the world at the present time are fiat systems; they do not allow free convertibility of the currency into a metallic standard, and money is given value by government fiat or edict rather than by its nominal gold or silver content. Modern systems are also described as managed currencies, because the value of the currency units depends to a considerable extent on government management and policies. Internally, the monetary system of the United States contains many elements of managed currency; although gold coinage is no longer permitted, gold may be owned, traded, or used for industrial purposes. It is a recurrent problem whether the value of inconvertible-credit currency can be maintained at a fairly stable level for extended periods of time.

Economic Importance

Credit, or the use of a promise to pay in the future, is an invaluable supplement to money today. Most of the business transactions in the United States use credit instruments rather than currency. Bank deposits are commonly included in the monetary structure of a country; the term *money supply* denotes currency in circulation plus bank deposits.

The real value of money is determined by its purchasing power, which in turn depends on the level of commodity prices. According to the quantity theory of money, prices are determined largely or entirely by the volume of money outstanding. Experience has shown, however, that equally important in determining the price level are the speed of turnover of money and the volume of production of goods and services. The volume and speed of turnover of bank deposits are also significant. *See* National Income.

The Monetary System of the United States

In the American colonies, coins of almost every European country circulated, with the Spanish dollar predominating. Because of the scarcity of coins, the colonists also used various primitive mediums of exchange, such as bullets, tobacco, and animal skins; many of the colonies issued paper money that circulated at varying rates of discount. The first unified currency consisted of the notes issued by the Continental Congress to finance the American Revolution. These notes were originally declared redeemable in gold or silver coins, but redemption was found impossible after the Revolution because of the excess of printed notes over metal reserves. Thus, the notes depreciated and became nearly worthless.

Early Monetary Regulations

In 1792 Congress passed the first coinage act, adopting a bimetallic standard under which both gold and silver coins were to be minted. The gold dollar contained 24.75 grains of pure gold and the silver dollar 15 times as much silver, making the legal mint ratio 15 to 1 (*see* Dollar). At this ratio gold was undervalued at the mint, as compared with its value as bullion, and very little gold was presented for coinage. Silver dollars also were largely withdrawn from circulation, because they could be exported to the West Indies and exchanged at face value for slightly heavier Spanish dollars, which were then melted down and taken to the mint for coinage into American dollars at a profit. Until 1834, when Congress adopted a mint ratio of 16 to 1 by reducing the weight of the gold dollar, the metallic currency was limited mainly to a meager supply of small silver and copper coins. The first Bank of the United States, which was chartered by Congress in 1791 for 20 years, and the second Bank of the United States, which existed from 1816 to 1836, issued bank notes that maintained a fairly stable value. Many state-chartered banks also issued notes that, because of the lax state banking laws, often greatly depreciated in value. After the closing of the second Bank of the United States, most of the paper currency consisted of notes of state-chartered banks and circulated only in a limited area.

After 1834, silver was undervalued at the mint; its market value was constantly higher than its coin value. As a result, gold gradually replaced silver in the monetary stock, especially after the discovery of gold in California in 1849. To relieve the

famine in small coins, Congress, in 1853, reduced the weight of the half-dollars, quarters, and dimes by 7 percent. Because the new subsidiary coins were worth more as money than as bullion, it was possible to keep them in circulation. As a result of a revision of the coinage laws in 1873 the silver dollar was omitted from the list of coins authorized to be minted. Although the coinage of silver dollars was resumed in 1878, the metallic gold dollar remained the monetary standard of value in the U.S.; thus, bimetallism was legally discontinued and the gold standard adopted. Actually, silver dollars had been an insignificant part of the currency since early in the century.

During the Civil War the governments in both the North and the South financed their needs through the issue of fiat money. The notes issued by the Confederate treasury and the southern states became entirely worthless after the war. The U.S. notes (greenbacks) and other paper money issued by the federal government also depreciated rapidly, especially after the suspension of payment in specie (redemption of paper money with coins, usually of gold or silver) in 1861, and gold and silver coins were driven out of circulation. In 1863, the National Banking Act authorized the establishment of national banks that could issue bank notes backed by government bonds. A 10 percent tax levied on state bank notes in 1865 forced state banks to discontinue issuing them, thus giving the national banks a monopoly of bank-note issue. The state banks, however, remained an important element in the banking system.

After the elimination of the silver dollar in 1873, the greatly expanded production of silver in the West caused the value of silver to fall sharply and led to agitation by the silver interests for restoration of the free coinage of the silver dollar. In this effort they were joined by political groups who favored the free coinage of silver as a means of improving general economic conditions. This agitation led to the passage of the Bland-Allison Act in 1878 and the Sherman Act in 1890, under which the Treasury was directed to purchase larger amounts of silver for coinage. The former law also created the silver certificate, which remained an important part of U.S. currency until it was retired in 1968. The Sherman Act, which introduced into the stream of currency an enormous quantity of overvalued silver and caused a drastic decline in the gold reserve of the Treasury, helped to bring on the panic of 1893 and was repealed by Congress in that year. Even so, silver was the main issue in the 1896 presidential campaign, when William Jennings Bryan called for free coinage of silver at a ratio of 16 to 1. The silver forces were defeated, and in 1900 the Gold Standard Act affirmed the gold dollar as the standard unit of value.

Federal Reserve System

The next important change in the currency system was introduced by the Federal Reserve Act of 1913, which authorized the establishment of 12 regional Federal Reserve banks, with power to issue two types of currency (*see* Federal Reserve System). The first, and most important, was the Federal Reserve note, which is issued under conditions consistent with economic stability and the needs of trade and industry. As member banks require more currency, they can obtain it from the Federal Reserve banks by drawing on their deposits or borrowing or rediscounting

commercial paper if their deposit balances with the Federal Reserve banks are insufficient. The second type of Federal Reserve currency, the Federal Reserve Bank note, was originally intended to replace the national bank notes, but never became a permanent part of the currency because the Federal Reserve notes proved adequate. The national bank notes were retired in 1935, but greenbacks are still part of U.S. paper currency.

European Monetary System (EMS), system that aims to facilitate financial cooperation and monetary stability within the European Union (EU). The EMS came into existence in March 1979 as a response to the instability of European economies, caused by fluctuating exchange rates in the wake of the 1974 oil crisis. Its purpose was threefold: (1) to establish monetary stability, (2) to overcome constraints caused by the interdependence of EU economies, and (3) to aid the long-term process of European monetary integration.

The central component of the EMS is the Exchange Rate Mechanism (ERM), a voluntary system of semi-fixed exchange rates, based on the European Monetary Unit (ECU)—the standard monetary unit adopted at the creation of the EMS and based on a weighted basket of member states' currencies. Under the ERM, participating currencies are allowed to fluctuate in relation to each other and to the ECU, but only within a fixed band.

The ERM is a key instrument in the plan to achieve a single European currency administered by an EU central bank—the ultimate aim of the EMS, and a central part of the 1992 Treaty on European Union (Maastricht Treaty). A target date of January 1, 1999 is set, but full monetary union is now expected to be a much longer and more complex process. Not all EU members belong to the ERM. Greece has yet to join, while the United Kingdom and Italy were forced by speculative pressures to suspend membership in September 1992. To prevent more countries from being forced out, in 1993 the ERM band was widened for all currencies except the Dutch Guilder and the Deutschmark. This action left only the Netherlands and Germany within the 2.25 percent band—one of the conditions for adoption of a single currency. By April 1994, Belgium, Denmark, France, Ireland, and Luxembourg were back within the 2.25 percent band, but Spain and Portugal remained under pressure; in March 1995 they were forced to depreciate their currencies against the ECU. Meanwhile, the United Kingdom and Denmark have negotiated the right to opt out of monetary union when EU heads of state meet in 1996 to decide whether to proceed with full or partial integration.

1. PROFESSIONS AND TRADES CAREERS IN BUSINESS.

2. TELEPHONING AND POST SERVICES

Telephone

In 1876 Scottish-born American inventor Alexander Graham Bell was the first to patent and produce a telephone. His patent was titled Improvement in Telegraphy, and contained the design of a device that would transmit the human voice over wires

instead of electrical clicks or other signals, like the telegraph. Originally, Bell thought that the telephone would be used to transmit musical concerts, lectures, or sermons. The American inventor Elisha Gray filed an intent to patent at the same time, but after many court battles, Bell was given the rights to the invention.

Bell and his financial backers established the Bell Telephone Company. In an extraordinary business move, Bell decided to lease telephones rather than sell them. His next step would be to build the connecting networks and sell services on those networks to customers. Bell began by leasing pairs of telephones that would connect two locations, such as a businessman's home and office, or between two partners' offices. However, the real appeal of telephone service emerged with the opening of the first telephone exchange—a switchboard connecting any member of a group of subscribers to any other member—in 1878.

The Bell Telephone Company established as many exchanges as possible, especially high-quality voice lines for wealthy city customers. Some customers resisted using the telephone at first because it did not leave a written record of transactions or orders; however, others saw this feature as an advantage. By 1894 roughly 260,000 Bell telephones were in use in the United States, about one for every 250 people.

After Bell's patents expired in 1893 and 1894, other companies began manufacturing telephones, wiring new networks, and installing exchanges. The new exchanges connected people in rural communities and residential households. Some were rural cooperatives owned and operated by the customers. The American Telephone and Telegraph Company (AT&T), which bought the Bell Telephone Company in 1900, developed switching systems to connect calls between exchanges, and eventually began experimenting with long-distance connections.

Between the 1880s and the 1980s the telephone system in the United States had an enormous effect on the quality of life and work. In rural communities, telephone service meant an end to the isolation and loneliness experienced by many farm and ranch families. Families whose members moved away to school or new jobs could stay in contact with each other over the phone. For ill or disabled people, the telephone became an indispensable link to the outside world. Telephone service also enabled immediate contact with emergency services, such as the police, fire department, or emergency medical services. By the 1960s the telephone was considered so essential that telephone companies provided basic services at reduced rates to elderly and disabled people.

The telephone network has also provided the electronic network for new computer-based systems like the Internet (a worldwide interconnection of computers and computer networks), facsimile transmissions (copies sent electronically by fax machines through telephone lines), and the World Wide Web (library of resources stored on computers and accessed through the Internet). The memory and data-processing power of individual computers can be linked together and data transmitted over telephone lines, even internationally via satellite, by connecting computers to the telephone network through telephonelike devices called modems (modulator-demodulators). The telephone network itself now relies extensively on

computer-based switches and exchanges that have made all kinds of new telephone-related services possible, such as call waiting, call forwarding, call return, voice-mail services, and caller ID. The relationship today between computers and the telephone system is inseparable.

Postal Services

Different societies have also devised systems for transporting messages from place to place and from person to person. The earliest were courier-type services; messengers carried memorized or written messages from one person to another, and returned with the reply. The Persian and Roman empires and some Asian societies sent couriers regularly along planned routes to retrieve reliable and timely information about trade and military affairs from distant areas.

In Europe, similar systems were established by commercial concerns and merchants who needed to exchange information about trade routes and goods. The ruling aristocracy used trusted messengers to carry confidential or sensitive information from capital to capital or kingdom to kingdom, but they were typically soldiers or servants. Over time, these arrangements evolved into government-operated systems for any citizen or subject to post messages to any other, financed by charging users a tax or fee for postage (verified by postage stamps).

In the United States, the postal service was established by the government in 1789, and the postmaster general's office was created to supervise the mail service. The first postmaster general of the United States was Benjamin Franklin. In the late 19th century, as the United States expanded its territory west beyond reliable roads or rail lines, the U.S. Post Office started the Pony Express, reviving courier-style services in the new territories. Pony Express riders carried sacks of mail through rugged and remote territory, relaying their loads from one rider to the next. The Pony Express quickly became renowned for its speed of delivery.

Over time, the U.S. Post Office took advantage of new transportation systems. Huge volumes of mail were sent across the country on trains, and the Post Office started its own postal security force to prevent the mail from being stolen in railroad holdups. They were also the first postal service to hire pilots to fly mail to distant or rural locations within the United States and overseas. By the 1930s every small town and rural route had carrier service; in many places, deliveries were made twice a day. As demand for postal services grew, the U.S. Post Office developed systems for coding and sorting the mail more quickly, notably the neighborhood ZIP Code system in the 1960s.

The U.S. Post Office became a private operation in the 1970s under the supervision of the U.S. federal government, and was renamed the U.S. Postal Service (USPS). Today the USPS is self-supporting, and is exploring a number of new technologies that will allow it to offer better service at lower cost, including electronic document delivery services and new electronic sorting systems.

Telegraphy

The first truly electronic medium was the telegraph, which sent and received electrical signals over long-distance wires. The first practical commercial systems were developed by the physicist Sir Charles Wheatstone and the inventor Sir William F. Cooke in Great Britain, and by the artist and inventor Samuel F. B. Morse in the United States. Morse demonstrated the first telegraph system in New York in 1837. But regular telegraph service, relaying Morse code (system of code using on and off signals), was not established until 1844. Telegraphers would translate the letters of the alphabet into Morse code, tapping on an electrical switch, or key. The telegrapher at the other end of the line would decode the tapping as it came in, write down the message, and send it to the recipient by messenger.

Telegraph systems were immediately useful for businesses that needed to transmit messages quickly over long distances, such as newspapers and railroads. A telegraph room installed in the United States Capitol in 1844 was the center of a sensation when news of the nomination of James K. Polk as the Democratic presidential candidate was conveyed by telegraph between the convention in Baltimore, Maryland, and the Capitol Building in Washington, D.C. In cities, thousands of telegraph lines suspended on poles webbed the streets by the latter half of the 1800s. Telegraph cable was first laid under the Atlantic Ocean in 1858, and regular transatlantic telegraph service began in 1866.

The telegraph made it possible for many companies to conduct their business globally for the first time. Because price changes could be communicated almost instantaneously, the telegraph also prompted the reorganization of American commodities markets. Prices became uniform from city to city, and futures (agreements to buy a commodity at a fixed price on a fixed date in the future) markets were established. In addition, standard time zones across the United States were established so that railroads could set regular and consistent schedules as trains moved across the country, enabling the railroads to check on schedules, passengers, and freight via telegraph.

Telegraph technology became more sophisticated, especially after its competitor, the telephone, was introduced in the 1890s. Telegraph systems evolved into telex systems, in which machines eliminated the need for coding and decoding the messages. Users could type in a message, and the identical message would appear at the recipient's end, carried over telegraph and telephone lines (and eventually satellite systems) to telex machines anywhere in the world. In remote areas where long-distance telephone service was unavailable or impractical, telex machines were widely used (much like an early version of electronic mail). Telegraph and telephone lines were also used to transmit pictures via an early version of facsimile called telefacsimile or Wirephoto service; newspapers used Wirephoto to transmit photographs as early as the 1930s.

Airmail, postal matter transported in aircraft over part of its trip, or the system for so transporting postal matter. The first airmail service consisted of a few irregular trips

early in 1911 between two English cities within a few miles of London. The first authorized U.S. airmail was flown between Garden City and Mineola, New York, in September 1911. Regular airmail service from London to Paris was begun in 1919 and air parcel post over the same route in 1922. The first regular airmail route in the U.S. was established between New York City and Washington, D.C., in 1918. Transcontinental service, between New York City and San Francisco, began in 1921; the scheduled flying time varied from 29 to 33 hours, but the planes flew only during the daytime. Day-and-night service over the same route was established in 1924. Regular, scheduled, transoceanic airmail was inaugurated in 1935 with service between the United States and the Philippines. Before 1935 the *Graf Zeppelin* had carried some mail across the North Atlantic Ocean, and there had been airmail flights across the South Atlantic from Africa to Brazil, but regular airmail flights across the North Atlantic between Europe and the United States did not begin until 1939, on a route between New York City and Marseille, France.

In the meantime international airmail arrangements had been made. Some provisions were included in the agreements reached at the International Postal Convention held in Madrid in 1920. The International Air Mail Conference was held in 1927, at which it was agreed that a uniform cost would be established to enable each country's airmail service to carry airmail of countries with similar service. Lack of agreement concerning the right of the aircraft of one country to fly over the land of another has not affected the amicable workings of the airmail accords.

In 1935 there were about 46,349 km (about 28,800 mi) of regular airmail routes in the U.S. (excluding service within Alaska), over which approximately 4,963,898 metric-ton-km of mail were flown, at an average cost to the U.S. Post Office Department of $1.78 per metric-ton-km. In 1945 there were more than 91,411 km (56,800 mi) of regular domestic routes (excluding Alaskan service), over which approximately 89,788,155 metric-ton-km were flown at an average cost of 39.2 cents per metric-ton-km. By 1968 more than 443,830,880 metric-ton-km of mail were flown.

In 1952 the Post Office Department experimented with shipping a limited amount of first-class mail by air between New York City and Chicago and between Chicago and Washington, D.C. This service was later expanded, according to the amount of unused cargo space available on regular airlines, and in 1975 the postal service merged domestic airmail with first-class mail. In 1977 the postal service established an overnight express mail service. By the mid-1980s all categories of domestic air-eligible mail transported exceeded 76 billion pieces, which equaled about 9 million metric tons.

3. TRAVELLING AND MEANS OF TRANSPORTATION

Transportation, conveyance of people or property from one place to another. Modern commercial transportation serves the public interest and includes all the means and facilities used in the movement of people or property, and all services involved in the receipt, delivery, and handling of such property. The commercial transportation of persons is classified as passenger service and that of property as freight service. *See Also* Public Transportation.

The early refinement of water transportation was stimulated by the tendency of populations to center on seacoasts or navigable waterways. The ancient Romans used vessels equipped with sails and several banks of oars to transport their armies to Carthage and other theaters of operations. Improvements were subsequently made in shipbuilding and in the rigging and manipulation of sails. With these changes, along with the adoption of the mariner's compass, sailing in the open sea out of sight of land became feasible. *See* Ships and Shipbuilding.

Transportation overland developed at a much slower pace. For centuries the customary means of travel, which was restricted to animalback, and animal-drawn carts or sleds (*see* Carriage; Coach), rarely exceeded a rate of 16 km/h (10 mph). Overland transportation showed little improvement until the 1820s, when the British engineer George Stephenson adapted the steam engine to a locomotive and initiated, between Stockton and Darlington, England, the first steam railroad.

Transportation in the U.S.

Five modes of transport are used in the U.S.: water, road, rail, air, and pipeline.

Water

Since colonial American settlements were generally confined to the coasts of rivers or lakes, the first transportation routes in the colonies were natural waterways, and the most efficient means of travel was by boat.

Steamships

The first efficient steamboat, the *Clermont,* was built by the American inventor Robert Fulton. The *Clermont* made its maiden trip in 1807 on the Hudson River from New York City to Albany, accomplishing the round-trip distance of almost 483 km (almost 300 mi) in 62 hours. The first ship to employ steam propulsion in a transatlantic crossing was the American vessel *Savannah* in 1819, although sail was used during part of the 29-day voyage. By 1840 a steamship could make six trips between America and Europe in the time a sailing ship could make three. The so-called clipper ship, a fast and beautiful type of sailing vessel, was the last stand of the commercial sailing ship. It was built between 1845 and 1851, but could not compete after 1851 with the progressively larger and faster steamships. *See* Clipper.

Canals

Canal building flourished from 1815 to 1840, declining with the growth of the steam railroad. The Erie Canal, completed in 1825, opened an inexpensive route between the East and the West and diverted to New York City much traffic that had formerly gone down the Mississippi to New Orleans. New York City hence enjoyed a great advantage over Philadelphia and Baltimore, a situation that led to the urgent building by the latter cities of the Baltimore and Ohio Railroad and the Pennsylvania Railroad.

Modern Vessels

The diesel engine has given modern ships more economical operation and has largely replaced the steam engine. The use of nuclear power in ships at this time is largely confined to military vessels. Other developments in modern navigation are the hovercraft (*see* Air Cushion Vehicle), a vessel that rides on a cushion of air a few inches above the water or land; and the hydrofoil, a vessel equipped with winglike planes or struts that, at a certain speed, lift the hull out of the water to attain an even greater speed.

Water transportation accounted for about 16 percent of the freight shipped in the United States in 1990.

Road

In the original 13 American colonies, which extended west to the Mississippi River, the principal mode of land transportation was by packtrains and horses over Native American trails. By 1800 dirt roads were made by clearing away brush and trees from these trails. Many such roads, however, became almost impassable during inclement weather. In 1820 improved roads called turnpikes, on which tolls were charged by the private companies that built them, connected all major cities and were considerably superior to free roads. The U.S. Congress in 1806 provided for the construction of the first road, known as the Cumberland Road (*see* National Road), by the federal government. Its first section, completed in 1818, reached from Cumberland, Maryland, to a point on the Ohio River near what is now Wheeling, West Virginia; by 1852 the road extended to Vandalia, Illinois, a total distance of approximately 1290 km (about 800 mi).

Throughout most of the 19th century, however, local authorities were responsible for road building. Although expansion of the railroad network and increasing use of bicycles between 1890 and 1900 resulted in public demand for better roads, the advent of the automobile was the chief cause of a revival of government interest in road building. Congress approved the Federal Aid Road Act in 1916 and the Federal Highway Act in 1921, and additional federal and state highway legislation was subsequently enacted. The Federal Highway Act of 1956 authorized construction of the greatest network of highways in the world. *See* Road.

The overwhelming majority of passenger transportation in the United States is by road; in 1990 private automobiles (*see* Automobile) accounted for more than 80 percent of total U.S. passenger miles, buses only about 1 percent. In over-the-road

freight shipping, trucks accounted for more than one-quarter of the total freight shipped in the United States.

Rail

By 1830, shortly after Stephenson's railroad line began operation in England, the U.S. had 1767 km (1098 mi) of steam railroad. In 1839 the trackage had increased to 8000 km (5000 mi), and railroad growth was phenomenal from 1850 to 1910. Railroad construction greatly stimulated the settlement and development of the West. The first railroad in the U.S. was chartered in 1827, and actual construction was begun July 4, 1828, by the Baltimore and Ohio Railroad. Opened to the public May 24, 1830, from Baltimore to Ellicott's Mills, a distance of 21 km (13 mi), the first division of the railroad did not reach Cumberland, Maryland, until 1842. On July 1, 1862, President Abraham Lincoln signed the Pacific Railroad Act, which authorized the building and operation of a railroad between Sacramento, California, and the Missouri River. This was the beginning of the first transcontinental railroad, which was completed at Promontory Summit, Utah, on May 10, 1869, with the driving of a golden spike to connect the Union Pacific and the Central Pacific tracks. Land-grant aid to railroads was the most important form of public assistance during the period of railroad expansion. This form of federal aid flourished from about 1850 until 1871, when public opposition to the grants caused Congress to call a halt. The U.S. General Land Office in its 1943 annual report gave 131,350,543 acres (53,178,357 hectares) as the total amount of land expended.

By 1990, U.S. railroads handled less than 1 percent of intercity passenger transportation, but the majority of the freight shipped in the United States, about 38 percent, went by rail.

Air

Air transport is the most rapidly developing form of modern transportation. Although the American aviation pioneers Orville and Wilbur Wright made the first flight in a heavier-than-air craft at Kitty Hawk, North Carolina, in 1903, not until after World War I did air transportation achieve prominence in all countries.

Transcontinental airmail service was established in 1921 by the U.S. government. The Kelly Act of 1925 authorized the U.S. Post Office Department to make contracts with private companies for carrying the mail by air. The first contracts were let, or awarded, in 1926, and in 1927 the government-operated airmail routes ceased. Commercial air transportation under this act was advanced when airmail carriers, to reduce the cost of airmail contracts, were required to provide facilities for transportation of passengers.

After World War II commercial air carriers received even greater impetus as propeller airplanes became larger and more efficient. An important step was made in 1958 with the inauguration, by both British and U.S. airlines, of the jet airplane for commercial transportation. Apart from supersonic airplanes, a further advance in air travel was the introduction, in 1970, of the Boeing 747, frequently called the jumbo jet, which can carry from 360 to more than 500 passengers on regularly scheduled flights.

The second most popular form of passenger transportation, air travel accounted for more than 17 percent of U.S. passenger miles in 1990. Due to the high cost per mile for air cargo, air transport accounted for only about .39 percent of total intercity freight tonnage.

Pipelines

Although pipelines for water have been used since ancient times, the present pipeline industry did not come into existence until soon after 1859, with the discovery of oil near Titusville, Pennsylvania. By 1872 pipelines were a major element in the oil business, providing specialized transportation for liquefied products, including gas and pulverized coal.

The pipeline system of the U.S. comprises more than 700,000 km (more than 435,000 mi) of line, and it is still growing. In 1974 construction began on a new oil pipeline from the northern slopes of Alaska, at Prudhoe Bay on the Arctic coast, to the ice-free port of Valdez on the Gulf of Alaska, a distance of approximately 1270 km (about 789 mi). The cost of the pipeline, which was completed in 1977, was $10,000,000,000. The pipeline now transports nearly 1.7 million barrels of crude oil per day, which is 24 percent of total U.S. crude output, or 12 percent of total crude inputs to U.S. refineries, including foreign oil. The pipeline aroused strong opposition from conservationists who feared its potential harm to the region's ecology.

Although they only transport liquefied products, pipelines were responsible for about 20 percent of the total freight shipped in the U.S. in 1990.

Intermodal Transportation

Moving people or commodities in the same closed unit or container over two or more different modes of transport is known as intermodal transport.

Freight Service

Routed through railroads, motor carriers, ships, or airplanes, a freight container is locked and sealed at origin, and the contents are not disturbed until the seal is broken by the consignee when the freight is unloaded at destination; only one bill of lading or air waybill is issued. If foreign countries are involved, the freight moves under international treaties, which facilitate inspection by customs at national border points before final destination is reached.

Inland Terminals

The essential element in intermodal transportation is the motor truck or trailer that picks up or delivers the freight at origin and destination. A ship or an airplane cannot back up to a store door, factory, or warehouse, nor can a railroad car, except where industrial trackage is provided. Some airlines are using containers that are interchangeable with motor carriers but not with a ship or railroad car. An economic advantage of the airplane, not yet fully explored, is the ability to make strategically situated inland cities major export-import centers, and this capability can be implemented with interchangeable containers. This involves picking up or delivering

direct foreign air cargo at an inland point under a single air waybill or bill of lading. Such inland air terminal points now relate to their surrounding regions much as ocean ports have for centuries. Many airline executives believe the helicopter or STOL (short takeoff and landing) airplane, rather than a motor carrier, railroad, or inland water carrier, may be the answer to terminal point distribution.

Containerization

So-called roll-on/roll-off container ships take whole trailers with their bogies, or swiveling-trucks. Rigid conformity is not necessary, because any vehicle with wheels can be moved aboard and tied down. This type of ship has proved efficient on relatively short runs such as across the English Channel between Great Britain and Belgium, France, or the Netherlands. In contrast, many of the so-called lift-on/lift-off ships, for example, cannot interchange their containers with similar ships of another company because of variance in box sizes and structural differences. These discrepancies in turn affect the motor carriers equipped for specialized types of containers and limit them to certain ships. A similar distinction exists, although not to the same degree, with containerized rail shipments. The TOFC (trailer on flat car) is comparable to roll-on/roll-off ships, and the COFC (container on frame car) is comparable to lift-on/lift-off ships.

In an all-container ship, leading costs are approximately 1/20 that of a conventional ship of similar size. A container ship can discharge and load cargo in approximately 13 hours, compared with 84 hours for a conventional ship, thus affording faster turnaround time. In general, 500 metric tons per gang-hour can be handled with containerization, whereas 25 metric tons per gang-hour is a good average with conventional break-bulk methods.

LASH

Among other variations in intermodal transportation is LASH (lighter aboard ship). In this method, a parent ship carries detachable lighters, or barges, with the ship standing out in the stream while the lighters are shunted between ship and shore. This is advantageous where shallow water exists at a port and the conventional ship is unable to dock in the usual manner. Regardless of the type of port, the turnaround time on these ships can be as little as 8 hours.

Advantages and Disadvantages

In intermodal freight transportation the container is locked against pilferage and sealed against the weather, usual packing requirements are relaxed, and the freight is billed as a volume shipment. Interchange of material is expedited, and containers can be used for storage; some terminals are fitted with electrical outlets for maintaining refrigerated containers. Damage claims on container cargo have been found to be much lower, and pilferage has been almost eliminated. Intermodal efficiency and economy can be attained particularly well in marine transportation.

Short-sightedness and lack of cooperation have created difficulties in implementing the labor-saving costs of intermodal freight transportation. Among these are labor

opposition to it as a form of automation; the initial cost of specialized equipment; the installation costs of terminals for container operations; and foreign exchange difficulties on shipments for which international treaties have not been executed.

Passenger Service

The container principle has stimulated a German concern to design a container for passenger transportation on airplanes. Standardized units would carry more than 100 passengers and their baggage, each unit with its own galley and washrooms. The designers foresee these units transferred directly between airliners and railroad trains, or possibly buses, without disturbance of the passengers, and envision the use of jumbo jets for this operation. A forerunner of this idea operates at Dulles International Airport, near Washington, D.C., where a so-called mobile lounge shuttles between the terminal and a waiting airplane.

Regulation and Economics

In France, Great Britain, Italy, and many other countries of Western Europe, railroad, steamship, and air transportation facilities are government-owned. Motor carriers are nationalized only when operated in conjunction with a railroad or water carrier. In France and Great Britain, privately owned public motor carriers observe rules and regulations that differ from those for motor carriers operated in conjunction with railroads. Privately owned public carriers are regulated in all nations, with the minister of transport performing this function in most European countries. In the U.S., specialized agencies have been created by Congress for this purpose.

Many countries have established by law economic groupings in motor-carrier transportation over the highways. In the U.S., the legal classification imposed by the federal government divides motor carriers operating between states into the following categories: common carriers, which are granted Certificates of Public Convenience and Necessity for the right to haul freight for all persons seeking their services; contract carriers, operating under specific written contracts; private carriers, owned by commercial firms for transporting their merchandise; and exempt carriers, not subject to economic regulation, such as trucks used by farmers to haul their produce, taxicabs, and school buses.

U.S. Regulatory Agencies

The Interstate Commerce Commission, an independent agency, was established by Congress in 1887 and implemented subsequent legal powers. The commission regulates domestic common carriers engaged in interstate commerce comprising railroads; inland, coastwise, and intercoastal water carriers; motor carriers; pipelines; and domestic freight forwarders. It is the largest, oldest, and broadest in scope of the regulatory agencies, and its decisions have greatly affected U.S. economy and development.

The Federal Maritime Commission was reorganized as an independent agency, effective August 12, 1961, for the economic regulation of common carriers by water and others engaged in the foreign commerce of the U.S., such as foreign freight forwarders and terminal operators.

The Department of Transportation was created for the purpose of developing national transportation policies and programs. The Department of Transportation Act of 1966 transferred from other agencies to the secretary of transportation certain regulatory functions relating to safety of railroads, motor carriers, aircraft, pipelines, and water transportation. In addition, it transferred the United States Coast Guard, Federal Aviation Administration, and the Saint Lawrence Seaway Development Corporation to its direct control.

The Federal Aviation Administration is charged with the promulgation of safety regulations, including the examination, inspection, certification, and rating of aviators. It oversees all safety matters relating to manufacture, operation, and maintenance of aircraft and all flight inspections of air-navigation facilities, and provides for the enforcement of federal safety regulations.

The Department of Transportation was granted responsibilities for international air agreements and airline consumer protection with the dissolution of the Civil Aeronautics Board at the end of 1984. The board had been vested with economic regulatory powers over civil aviation within the U.S. and foreign countries. The termination of the board followed the passage by Congress in 1978 of a law designed to deregulate the U.S. domestic airline industry.

Economic Laws

Apart from government regulation, the transportation industry is subject to certain economic laws. The law of increasing returns asserts that expenditures do not increase in the same proportion as revenues when the volume of business increases. Once a transportation system is established with fixed capital, an expansion in the volume of shipments causes operating expenses to rise, but has little effect on constant expenditures and results in decreased expense per unit. This holds true as long as unused plant capacity is available, that is until, for instance, double tracking on a railroad is necessary, or, for a motor carrier, increased equipment and terminal facilities are required. In each mode of transportation the relationship of constant to variable expenses depends on its physical equipment and the nature of its operation.

The law of joint cost involves the production of two or more products from a single operation. The haulage of railroad freight cars, express cars, passenger cars, and other equipment over the same tracks precludes the assignment of costs on a scientific basis to any one item so transported.

Rates

Transportation rates are based on both economic laws. In all countries, these two fundamental economic laws are observed carefully. When a freight rate is high, it is normally a small proportion of the selling cost. Under the law of increasing returns, revenues to the carrier increase disproportionately to costs, especially when constant costs are a large part of the total costs. On the other hand, a commodity with a low margin or profit per unit may be charged a low freight rate to facilitate a wider market and bring the carrier a greater volume of traffic. The increased volume compensates for the lower rates only when the return pays the variable expenses and contributes something toward the constant costs. Some dissatisfaction with this

method of rate making by the railroads has been expressed by domestic water carriers in the U.S. Inland shippers believe that their industry has suffered because of this method, and they favor their system of fully distributed costs as being more just.

Statistics

Transportation is one of the largest industries in the world. In the U.S. alone, in the early 1990s the transportation industry employed nearly 3 million people annually. The annual pretax profits of the nation's transportation companies totaled about $5.1 billion in 1989.

4. TRAVELLING BY PLANE

Airport, area of land or water adapted for the landing and takeoff of aircraft. Large airports provide terminal buildings for the arrival and departure of passengers, as well as maintenance and repair facilities for aircraft. Requirements for handling aircraft at large military airfields are similar to those of civil airports.

Airports evolved from grass and dirt strips. The growth in size and weight of German aircraft during World War I, and the concomitant requirements for longer takeoff runs, necessitated paved runways for heavy bombers. The first paved runways for a civil airport in the U.S. were built in 1928 at Newark, New Jersey. Before World War II, Newark also experimented with landing lights, illuminated wind vanes, and other innovations. In Europe, the first paved runways at civil airfields were built in the late 1930s, but Great Britain did not have paved runways until World War II. Airport development and construction of concrete runways in the U.S. benefited from federal relief programs in the depression of the 1930s. After 1941, global deployment of U.S. armed forces produced military airfields all over the world; many of these became the basis for later civil air networks. As air travel mushroomed after the war, and a new generation of airliners demanded better airport facilities, thousands of new airports were built.

In 1990 the International Civil Aviation Organization reported 37,739 civilian airports in use throughout the world. The U.S. listed 17,327 airports at about the same time, 53 of which accounted for 73 percent of the 429,654,602 passengers enplaned in 1989. O'Hare in Chicago is the world's busiest airport; in 1989, it recorded more than 59 million passengers, about 790,000 takeoffs and landings, and 869,490 metric tons of cargo. London's Heathrow Airport, with the largest flow of international traffic in the world, had nearly 40 million passenger arrivals and departures. Typical of enormous traffic growth during the 1980s was the opening in 1990 of a third terminal at Florida's Orlando International Airport, where operations had swelled from 6 million passengers in 1981 to more than 17.2 million in 1989.

Throughout the 1980s, deregulation in the U.S. resulted in rate slashing and “frequent flyer” plans that brought unprecedented numbers of new travelers to the skies, creating congestion at major airports, as snarled ground transport systems proved ill-equipped to handle the strain of increased traffic. Meanwhile, rapidly growing international travel created similar problems at major airports in other parts of the world. Munich, for example, had to build an entirely new terminal, scheduled to begin operations in 1992, to replace an overcrowded facility whose traffic had grown from 1 million to 11.4 million passengers in less than three decades.

Design and Construction

With the growth of air travel, airports became symbols of international prestige after World War II, often designed by internationally renowned architects. An outstanding example was the award-winning 1962 design by the Finnish-American architect Eero Saarinen for the Trans World Airlines terminal at John F. Kennedy Airport in

New York City. Typifying the enthusiasm for aviation prevailing at the time, the building suggests flight, with two winglike roof sections of concrete and glass over the waiting-room areas. A striking series of new airports in the Middle East integrated new structural concepts with traditional forms of domes and minarets.

Increasingly, development of wide-bodied jet transports, such as the Boeing 747, made it difficult for airports to allow adequate space on the ground for maneuvering such aircraft while permitting convenient movement of passengers transferring from one airline to another. This became particularly acute in the U.S. as airlines created more and more central-city hubs to collect passengers for long, nonstop flights and redistribute them to short-haul or commuter flights to smaller cities. One approach to the problem was that of the Dallas-Fort Worth Regional Airport: a central access route for cars serving as the spine for a series of semicircular terminals, flanked on either side by pairs of parallel runways. Charles de Gaulle Airport, near Paris, exemplified another solution for dealing with escalating international traffic: a larger main passenger terminal surrounded by satellite terminals with their own arrival and departure gates. Other major airports employed variations on such themes; passengers were transferred between or within terminals by buses, automated passenger trains, and moving walkways. At Dulles International Airport outside Washington, D.C., passengers boarded mobile lounges that ferried them across crowded taxiways to waiting airliners.

Passenger Services

Major airports provide a wide range of facilities for the convenience of millions of travelers. These range from such basic features as ticket-sales counters, baggage-claim areas, rest rooms, and restaurants to luxury hotels, conference centers, shopping malls, and play areas for children. Other amenities include newsstands, bars, barbershops, post offices, and bank branches. Taxi stands, rental-car agencies, and huge parking lots are necessary to accommodate ground connections. Many airports, particularly in Europe and Japan, also supply direct rail links to expedite such traffic. International terminals must also have customs areas and currency-exchange counters; most have duty-free shops as well. For international travelers, the problem of language barriers is met by using standardized symbols. At American airports, the threat of aerial hijacking and terrorist activities has led to elaborate security procedures and increasingly sophisticated baggage-inspection equipment to protect passenger safety.

Airport Operation

Because aircraft must land and takeoff into the wind, the location of terminals and the layout of runways depend largely on the pattern of prevailing winds. Other determinants include geographic features, such as surrounding hills and mountains, and the desirability of avoiding approach and departure routes over crowded residential areas. Such requirements have made it increasingly difficult to find locations for airports. Suppressing noise and reducing air pollution have been major concerns of both airport engineers and airplane designers, but progress has not been

rapid enough to quiet mounting protests by environmentalists and other concerned citizens. Airport designers must take into account the weight and wingspan of airplanes when laying out hangars, cargo-loading areas, parking ramps, taxiways, and runways; wide-bodied jets, requiring thick concrete runways 60 m (about 200 ft) or more in width and 4427 m (14,000 ft) or more in length, have added to such problems. Enormous maintenance hangars are also required; a 78.9 by 379-m (262 by 984-ft) building at Munich's new airport will accommodate six Boeing 747-400s under one roof. The same complex will include an even larger 100 by 499.9-m (328 by 1,640-ft) air cargo terminal.

A standard feature of any airport is a control tower where air traffic controllers use computers, radar, and radio to keep track of air traffic and issue instructions for takeoffs, landings, and maintenance of safe distances between aircraft. As traffic multiplied in the 1980s and numbers of controllers failed to grow apace, this became increasingly difficult. In 1989, approximately 1600 close calls were reported on airport runways in the U.S. alone; the collision of two jetliners at Detroit Metropolitan Airport the next year under foggy conditions intensified efforts by the Federal Aviation Administration to improve ground radar systems, runway and taxiway markings, and safety procedures. *See* Air Traffic Control.

Support Vehicles

Airport operations require a diverse array of support vehicles. Conventional cars, jeeps, and trucks—painted bright colors for high visibility—crisscross runways and taxiways. More specialized vehicles are also necessary; heavy-duty, four-wheel-drive “tugs” latch on to an airliner's forward landing gear in order to tow it in and out of parking ramp areas. Special catering and supply trucks, the cargo space of which can be raised and lowered by hydraulic hoists, are used to resupply airliners with food and with water for drinking and for lavatories. Other adjustable gantry equipment can be employed for inspection and maintenance. Trucks are still used to provide many types of aircraft with fuel brought from “fuel farms” located at safe distances from terminals, but at particularly large airports, where dozens of wide-bodied jetliners and other aircraft may await servicing, fuel must be delivered by insulated underground lines to ramp areas, where mobile units pump it directly into an airliner's tanks.

Other vehicles required for safe operation of an airport include emergency and fire-fighting equipment, such as fire-suppression vehicles equipped to discharge water, chemical foams, and powders at high velocity over considerable distances. Also available are medical units and ambulances. Busy airports experience frequent full alerts as traffic mounts.

New Operations

By 1990, with projections indicating that annual passenger volume might double to 900 million in the U.S. alone within 10 years and a similar increase looming in international traffic, major airports continued to be built throughout the world. In addition to Munich's new facility, examples included Airtropolis Terminal 2 at

Changji Airport in Singapore, a technologically daring complex constructed in Japan's Osaka Bay, and a highly controversial new airport at Denver, Colorado.

Air Transport Industry, area of commerce that uses aircraft to transport people, cargo, and mail. The air transport industry encompasses flights of common carriers (government-certified companies that offer cargo and passenger services to the public) and general aviation (private aircraft used for recreation or business). *See also* Airplane; Aviation.

The air transport industry supports a wide range of businesses. These include independent maintenance and repair shops, food caterers, aircraft cleaning services, fueling services, and airport security firms. The industry supports schools for pilots, flight attendants, and mechanics, as well as travel agencies, hotels, car rental companies, and other businesses in the travel and tourism industry.

Origin and Development

Flying for pleasure and adventure began during the 19th century, when European inventors experimented with hot air balloons and gliders. In 1910 the air transport industry was established in Germany when regular air service with gas-filled airships called dirigibles began to provide service between cities.

The first powered flights in a heavier-than-air machine occurred on December 17, 1903, when Orville and Wilbur Wright made their historic flights at Kitty Hawk, North Carolina. On January 1, 1914, a group of Florida businesspeople launched the first scheduled air service using an airplane. For a period of four months, the Saint Petersburg-Tampa Air Boat Line transported a total of 1200 passengers across Tampa Bay in a two-seat Benoit seaplane. The trip took about 20 minutes, and the one-way fare was $5. The service folded at the conclusion of Florida’s winter tourist season, but it was the first such venture that indicated scheduled air service could be commercially viable. Similar passenger services in the United States and Europe soon followed.

Passenger air service developed faster in Europe than it did in the United States. World War I (1914-1918) devastated many of Europe’s roads and railroads. The war also proved the military value of airplanes and sparked a dramatic acceleration in aircraft production. At the end of the war, fledgling commercial air carriers took advantage of the ruined ground transportation system and the large surplus of aircraft and pilots. Air service within Europe flourished, and by the 1930s government-sponsored airlines were operating well beyond Europe to numerous European colonies in the Middle East, Africa, Asia, and Latin America.

Airmail and Passenger Service

The United States suffered none of the devastation that afflicted war-torn Europe. Trains in the United States were fast, reliable, and far more comfortable than airplanes, so there was relatively little demand for air travel after World War I. The government decision to use aircraft to transport mail kept the U.S. air transport

industry alive. Airmail service began on the East Coast in 1918 and by 1921 extended all the way to California. Initially the government used its own aircraft and pilots, but two laws of the mid-1920s were key to the development of commercial aviation in the private sector. The 1925 Contract Air Mail Act, also known as the Kelly Act, authorized the U.S. Post Office Department (*see* United States Postal Service) to solicit airmail bids from private airlines. The 1926 Air Commerce Act gave the U.S. government the authority and responsibility to regulate commercial aviation.

Many of the current major U.S. airlines descend from the early mail carriers, some of which were themselves subsidiaries of aircraft manufacturers trying to create new markets. Henry Ford, the auto manufacturer, was among the first to win airmail contracts. His Ford Motor Company soon began producing aircraft, introducing the Ford Trimotor, commonly referred to as the Tin Goose, in 1927.

The Ford Trimotor was one of the first all-metal planes and the first plane designed primarily to carry passengers rather than mail. It had 12 passenger seats, an interior cabin with a ceiling high enough for people to walk down the aisle without stooping, and room for a flight attendant. The first flight attendants were nurses who served meals and assisted airsick passengers.

The Trimotor helped airlines develop the passenger side of their businesses. An event in 1927 drew public attention to aviation and convinced many that the industry had a bright future. On May 21, 1927, a young American pilot named Charles Lindbergh made the first transatlantic flight from New York to Paris in a 8.5-m (28-ft) airplane named the *Spirit of St. Louis*. The feat catapulted Lindbergh into instant fame as a folk hero and helped attract millions of investment dollars to aviation.

Technological Advances

Numerous technological advances made between World War I and World War II (1939-1945) were key to the development of the air transport industry. Navigation was greatly improved in the 1920s when rotating beacons began to mark air routes for nighttime flight.

Radio, which developed around the same time as aviation, made it possible for pilots to communicate with each other and with people on the ground. By the 1930s radio signals from fixed locations were guiding pilots to their destinations in darkness and poor visibility.

Engineers also made numerous advances in aircraft design during the 1930s. Air-cooled engines helped reduce weight and made larger and faster aircraft possible. Cockpit instruments also improved, with better indicators for airspeed and rate of climb and better altimeters and compasses.

American aviator James Doolittle helped design the artificial horizon in the late 1920s. This instrument shows pilots the angle the aircraft’s wings make with the ground and is important for flying in reduced visibility.

In the 1920s engineers developed aircraft that resembled today's modern planes. These airplanes were all-metal with one wing on each side of the plane, an engine on each wing's leading edge, retractable landing gears, wing flaps to control speed, propellers with variable angles to increase climbing and cruising speeds, and enclosed cabins for the crew and passengers. One important aircraft developed at this time was the Boeing Company's 247, which was widely used as a passenger aircraft into the 1940s.

Another important aircraft was the Douglas Aircraft Company's DC-1, designed so the exterior surface of the plane bore most of the stress during flight, eliminating the need for an interior skeleton of metal spars, which took up space. A similar aircraft, the DC-3, proved even more popular with travelers and was the first plane that enabled airlines to make money carrying passengers rather than mail. It seated 21 passengers, more than any previous aircraft, and its 1000-horsepower engines made it possible to travel coast-to-coast in the United States in 16 hours, considered a fast trip in the mid-1930s.

The Boeing Stratoliner, introduced in 1940, was the first aircraft to have a pressurized cabin, an innovation that enabled airlines to fly in the thin atmosphere above storms and air turbulence that frequently gave passengers upset stomachs and deterred many people from flying.

World War II and Beyond

Aviation had an enormous impact on the outcome of World War II, and the war had just as big an impact on commercial aviation. Aircraft production increased dramatically during the war, and airlines for the first time had far more business than they could handle as governments recruited them for the war effort. Airlines also had opportunities to fly new international routes, gaining an exposure that would give them a head start after the war's end.

To meet military needs, aircraft engineers designed planes that were bigger, faster, and capable of flying farther than ever. Radar technology, which allowed pilots and controllers to get a better idea of situations in the air, made significant advances in England during World War II. As the war drew to a close, scientists working independently in Great Britain and Germany perfected the jet engine (*see* Jet Propulsion).

By the mid-1950s, more people were flying across the Atlantic Ocean than were crossing it on ships, and by the late 1950s there was more intercity travel in the United States by air than by rail or bus. The first successful commercial jet, the Boeing 707, entered service in 1958, making air transportation considerably faster and more comfortable for passengers and reducing airline maintenance costs through improved engine reliability.

Jumbo jets debuted in the 1970s and boosted airline carrying capacity. Also in the 1970s, the governments of France and Great Britain jointly developed the first commercial jet to fly faster than the speed of sound, the Concorde, radically reducing transatlantic travel times.

Government Regulation

Numerous governments around the world regulate the air transport industry. In the United States, government regulation began in 1926, when the Commerce Department set the first standards for pilots and aircraft and began establishing air routes and navigation systems and investigating accidents.

In 1938 the Congress of the United States created the Civil Aeronautics Authority (CAA) to bring financial stability to the industry through regulation of airline routes, fares, and safety. It also created an independent Air Safety Board for accident investigations.

The CAA went through several name changes and reorganizations before the Federal Aviation Agency (FAA) took over many of its duties in 1958. The FAA's task was to develop and operate a nationwide air traffic control system and regulate the airlines on all matters of safety. The Civil Aeronautics Board (CAB), a descendant of the CAA established in 1938, retained jurisdiction over airlines' routes and rates until deregulation occurred in 1978 (see *Effects of Deregulation on Airlines* below). The CAB also handled accident investigations until the creation of the National Transportation Safety Board (NTSB) in 1967.

The British Civil Aviation Authority (CAA) regulates air travel within Great Britain. The International Civil Aviation Organization (ICAO), affiliated with the United Nations, was established in 1947. It sets safety and navigation standards for international carriers.

Aircraft Manufacturing

Soon after the Wright brothers made their first flight, the aircraft manufacturing industry began to grow. American manufacturer Glenn Curtiss founded Curtiss Aeroplane Company in 1907, just four years after the Wrights' first flight. The Wright brothers created the American Wright Company in 1909. Curtiss Aeroplane combined with American Wright to form the Curtiss-Wright Company in 1928. Other important American aircraft manufacturers were Martin MB, founded in 1912 by American manufacturer Glenn Martin; the Boeing Company, founded in 1916 by American aircraft designer William Boeing; Chance Vought, founded in 1917 by American manufacturer Chance Vought; Douglas Aircraft Company, founded in 1920 by American engineer Donald Douglas; Northrop Aviation, founded by American pilot Jack Northrop in 1929; and Grumman Aircraft Engineering Corporation, founded in 1929 by American pilot Leroy Grumman. The major European aircraft manufacturer Airbus Industrie was founded in 1970.

Today the production of commercial air transport equipment is a multibillion dollar global industry. High-priced aircraft and components are manufactured in countries throughout Asia, Europe, and North and South America. Most of the final assembly of large jets, a single one of which can cost as much as $175 million, is performed in either the United States or France.

The three principal aircraft manufacturers today are Airbus Industrie (a consortium of several European aerospace companies), the Boeing Company, and the

McDonnell Douglas Corporation, both in the United States. Boeing and McDonnell Douglas announced their merger in 1996. Two of the three large jet engine manufacturers—the General Electric Company and Pratt & Whitney (a division of United Technologies Corporation)—are also based in the United States. The third is Britain's Rolls Royce PLC. Other companies based in Brazil, Canada, Germany, Great Britain, Ireland, Italy, the Netherlands, Spain, and Sweden, as well as France and the United States, specialize in the production of smaller aircraft used by regional carriers and for general aviation.

Future of the Air Transport Industry

The air transport industry has grown enormously in recent decades and is projected to continue growing strongly into the next century, particularly internationally. Over the past 30 years, the number of passengers worldwide grew from 177 million in 1965 to an estimated 1.26 billion in 1995. U.S. airline passengers for the same period grew from 103 million in 1965 to an estimated 548 million in 1995. The U.S. airlines transported their 10 billionth passenger in scheduled service in June 1995, 81 years after the start of scheduled service.

Common Carriers

Common carriers offer scheduled and charter flights to international, national, regional, and local destinations. Depending on the length of the trip and the amount of cargo or number of people to be carried, common-carrier aircraft range from small, single propeller airplanes to large, four-engine jet airplanes.

Several types of passenger and cargo airlines exist in the United States. Major carriers, airlines with annual revenues of $1 billion or more, use large jet transports to provide a combination of short-range and long-range services. National carriers have annual revenues between $100 million and $1 billion. They serve more limited markets than the major carriers, but also mostly use jet aircraft.

Regional carriers are the smallest airlines, with annual revenues less than $100 million. These carriers provide a regional focus to their services, and in many cases, their flights are structured to connect with the services of larger airlines. While some of the larger regional carriers operate jet aircraft, most use airplanes with propellers. The smaller regional carriers are often called commuter carriers.

Air Cargo

Air cargo includes all shipments of mail and freight by air. Government mail contracts were the airlines' primary source of revenue in the late 1920s and early 1930s in the United States. Freight also moved by plane during that time, notably in the Great Lakes region where the Ford Motor Company flew parts between auto assembly plants.

Relatively little freight was shipped by air until the development of larger aircraft in the late 1930s because the smaller planes could not carry much weight. Even in the 1930s airfreight was limited to lightweight commodities such as clothing, high-value

items such as jewelry, and time-sensitive items such as flowers, fresh fruit, and machine parts for assembly lines.

Airfreight became a major business after World War II with the spread of international air service and the introduction of large jets with greater lifting capacity. Later, the development of jumbo jets and the acceleration of international trade spurred the industry's growth. Decisions by many manufacturers to subcontract production to low-cost labor markets and to minimize inventory costs by delivering only what factories needed at the moment meant that the manufactures needed more air cargo shipped more often, benefiting the air transport industry.

There are two basic types of air cargo carriers. All-cargo carriers only deal with freight. Combination carriers carry both passengers and freight.

All-cargo airlines fly freighters, which are passenger aircraft that have been altered for cargo operations. Freighters have no seats or windows in the main cabin. They have larger doors than planes configured for passenger service, and reinforced floors, many fitted with rollers to facilitate sliding of heavy items. Many modern freighters also have hinged tails or noses that allow for loading large items.

Some combination carriers also use freighters, and some fly aircraft with a main deck that is split into two compartments, one for cargo and one for passengers. Most common carriers, including the major U.S. common carriers, transport cargo solely in the belly space of their passenger jets. Jumbo jets have a huge amount of space in their lower decks.

Shippers usually pay more to ship by air than to ship by truck, rail, or sea. Savings in areas such as inventory costs, damage, and theft often offset the higher airfreight costs. Most air cargo today moves in sealed metal containers that cut down on theft and damage and help make loading and unloading on aircraft faster and easier. Shipping by air over long distances is also much faster than long-distance shipping by other modes of transportation, and thus the only choice for such shipments as express mail, live seafood, and cut flowers.

The air transport industry today handles many types of freight, from computers to live animals. Airplanes do not carry heavy bulk commodities such as coal, iron ore, grain, and oil, so air carriers handle only a tiny percentage of the total weight of worldwide cargo. However, they carry a major share of high-value shipments.

General Aviation

General aviation encompasses the part of the air transport industry not included in military aviation, common carrier passenger service, or cargo service. It includes recreational flying as well as such small-business flying ventures as aerial photography, aerial advertising, crop dusting, and flight instruction.

General aviation also includes all flying in corporate-owned or leased aircraft, and in air taxis, which provide on-demand services from fixed locations. While much of general aviation is commercial, the companies that offer these many services are not legally defined as common carriers. Their services are provided to select clients at negotiated rates rather than to the public at large, and they do not have the same

carrier certification requirements as the airlines. General aviation constitutes about 98 percent of all flying in the United States.

Trends

Business, or corporate, flying has been one of the fastest growing areas of general aviation since World War II. Private corporate aircraft can land at more airports than commercial jets and often can transport business travelers where they want to go faster and more directly than commercial airlines.

Private recreational flying has leveled off over the past two decades as many people are unwilling to make the investments in time and money necessary to obtain and maintain pilot licenses. Also in recent years, U.S. production of small aircraft came to a near standstill as a result of skyrocketing insurance liability costs. Recent changes in U.S. liability laws seem to have turned that situation around, but manufacturers in other nations now hold a significant share of the small-plane market.

Economic, Safety, and Regulatory Trends

In 1978 the U.S. Congress deregulated the U.S. airline industry, allowing carriers to serve any domestic market and charge whatever they thought the market would bear. This legislation abolished the Civil Aeronautics Board and it officially shut down on January 1, 1985. The Department of Transportation took over some of the CAB's responsibilities. Safety regulation and responsibility for maintaining and operating the air traffic control system remained with the Federal Aviation Administration (FAA).

Airline deregulation was intended to foster competition in the air transport market and bring better service and lower prices to air travelers and shippers. Numerous academic and government studies have concluded that deregulation has been successful. During the 1980s the major airlines established "hub-and-spoke" route networks, in which an airline uses a few cities as major bases (hubs) and flies to other airports (spokes) from the hubs. These hub-and-spoke networks improved the service and competition to most areas of the country. Airline prices have also declined, when adjusted for inflation, and the new competitive climate has fostered numerous innovations of benefit to travelers, including frequent-flyer programs and computer reservation systems that make it easier for travel agents to shop for and book air travel for customers.

Effects of Deregulation on Airlines

For airline carriers, deregulation created both opportunities and dangers because it forced them to operate without a financial safety net, which had set a lower limit for fares, provided by the government. During the 1980s entrepreneurs launched dozens of new airlines—most of which failed—and existing carriers intensified competition by expanding into markets they had not served previously. Numerous mergers occurred in the second half of the decade as carriers attempted to gain a greater share of the market and expand quickly.

Many airlines changed ownership or went bankrupt during the first decade of deregulation. Among the airlines that failed were some of the oldest names in aviation—Eastern Airlines, Braniff International, and Pan American World Airways. By the early 1990s, economic recession, high fuel costs, fears of international terrorism, and a greater number of seats that passengers were causing huge losses across the industry. By the mid-1990s profitability returned for many airlines following intensive cost-cutting and downsizing. Many of the people who had lost their jobs because of airline bankruptcies were again working in the industry, this time for some of the new so-called niche market carriers, which specialized in serving small areas of the market.

Southwest Airlines, a small carrier operating within Texas before 1978, was one of the most successful airlines following deregulation. With its low-fare, no-frills service in short-haul markets, Southwest lured many travelers away from car travel and other airlines, in the process growing into a major airline. Other major successes occurred in the overnight delivery business—a new type of service pioneered by Federal Express Corporation, which developed a hub-and-spoke network for door-to-door deliveries nationwide. Regional airlines flourished, too, expanding their small-plane service into many of the small communities abandoned by the big jet operators.

International Regulation

Unlike U.S. domestic air service, international service remains highly regulated. Service levels between most countries is governed by bilateral aviation agreements that typically specify which cities may be served, the frequency of the service, and sometimes even the total number of seats that can be offered for sale.

Pricing restrictions also are sometimes included in these government-to-government agreements, as well as restrictions on what carriers can do on the ground—for instance, whether they can set up a trucking subsidiary to move freight to off-airport locations. International air service is growing less restrictive, but very gradually.

In the early 1990s the United States negotiated so-called open sky bilateral agreements that place no restrictions on service levels or pricing with several European nations. Those nations are Austria, Belgium, Denmark, Finland, Iceland, Luxembourg, the Netherlands, Norway, Sweden, and Switzerland. In addition, nations belonging to the European Union (EU) have agreed to lift restrictions on all air travel between and within their own countries, making air transportation within the EU more like domestic air transportation in the United States.

Safety

Commercial aviation has become significantly safer since the early decades of the industry. This is due in large part to better, more reliable aircraft and engines, as well as better navigation and landing aids on the ground. Most accidents today are due to human error, but training for pilots is becoming more technologically advanced and extensive.

Major advancements in training in recent years include the development of flight simulators that enable pilots to train for adverse conditions and situations that would be difficult or dangerous to replicate in real airplanes. The U.S. government recently applied to regional airlines the same training requirements that apply to large carriers.

The threat of terrorism aboard aircraft has motivated airports to increase security and control over who and what gets onboard airplanes. Passengers must walk through metal detectors in many airports. Some airports and airlines use X-ray technology, drug-sniffing dogs, and other security measures to examine baggage before it is loaded on an airplane.

5. TRAVELLING BY TRAIN

Passenger Cars and Service

The earliest passenger cars, about 4.6 m (about 15 ft) long and 2.1 m (7 ft) wide, were virtually stagecoaches with railroad wheels. Soon larger cars with six wheels instead of four were introduced. In this country, the Baltimore & Ohio was the first road to offer passenger service, in 1830, and only three years later this line introduced a car similar to the cars used for the next 100 years. It seated 60 passengers and was mounted on two four-wheeled swiveling trucks. Swiveling trucks permit the car to follow curves more readily and are now used in passenger car construction throughout the world. In the 20th century, six-wheeled trucks became necessary in the U.S. and Canada to bear the weight of all-steel cars.

Until 1904, passenger cars were made entirely of wood. In that year, cars with steel underframes were introduced on the suburban lines of the Illinois Central Railroad serving Chicago, and they soon came into general use. In the same year the pioneer subway in New York City set an example by introducing all-steel cars. Within a short time such cars appeared on the Long Island Railroad and on the suburban lines of the New York Central Railroad, and in 1906 the Pennsylvania Railroad put an all-steel car into long-distance service. Within 20 years such cars constituted about one-third of all passenger cars in the U.S. After 1930 few passenger cars were built of other materials until the new lightweight alloys were developed. Steel cars proved safer and more durable than wooden cars, but they increased operating costs by requiring locomotives to pull more weight in carrying the same number of passengers. The lightweight cars, of aluminum alloy or stainless steel, and double-decker coaches, which have two tiers of seats, have considerably reduced this ratio.

A U.S. or Canadian passenger car of typical design has a longitudinal central aisle with a row of transverse seats on either side. Each seat usually accommodates two passengers, and in many cars seat backs may be tilted to allow passengers to sleep in a semireclining position. European cars are divided into transverse compartments. These compartments can be entered only from the outside in most of the cars used in local service in many countries. Other trains have a narrow corridor along one side and thus permit passengers to reach lavatories and dining cars during the trip. U.S. sleeping cars and parlor cars, with porter service and individual reserved seats, correspond roughly to European first-class accommodations, and ordinary day coaches correspond to second-class cars.

Sleeping Cars

The first sleeping car in the world, a crude affair with tiers of berths along one wall, was introduced in the U.S. in 1836. In 1859 the American inventor George Mortimer Pullman converted two Alton Railroad coaches into sleeping cars, and in 1864 he patented the first sleeping car of the type that remained standard in the U.S. for nearly three-quarters of a century. Modern sleeping cars contain a number of individual rooms called roomettes, bedrooms, or compartments. Rooms have toilet

facilities, mirrors and electric lights, liberal space for luggage and personal belongings, and individual heating and air-conditioning controls.

Amtrak

Passenger service was greatly improved during the 1930s, when lightweight, streamlined cars, air conditioning, and faster schedules were introduced. Following World War II, however, the passenger train began a long decline in popularity. By the late 1960s, after the railroads lost almost all mail and express business, the end of the passenger service appeared near. Congress responded by creating the National Railroad Passenger Corporation (Amtrak) in 1971 to assume responsibility for intercity passenger trains throughout the U.S. By most standards, Amtrak succeeded in reviving passenger train service. The number of passengers carried annually rose from 16.6 million in 1972 to 20.2 million in 1986. By 1982, Amtrak had replaced almost all of the aging passenger cars and locomotives it had inherited from several railroads with new or completely rebuilt equipment. Besides owning the rolling stock, Amtrak employs most onboard personnel and pays railroads for the use of their tracks and facilities. Deficits amounting to hundreds of millions of dollars per year are met by congressional appropriations. In 1976 Amtrak purchased trackage between Boston, New York City, and Washington, D.C., from Penn Central (now a part of Consolidated Rail Corporation) and began to upgrade the property for speeds of at least 190 km/h (about 120 mph). By the late 1980s Amtrak operated about 250 trains per day over more than 38,600 route km (24,000 route mi) across the U.S. A typical overnight Amtrak train includes a baggage car, several coaches, one or more sleeping cars, a dining car, and a lounge car, or a car that combines both dining and lounge facilities. In the western U.S., most Amtrak cars contain two levels of coach seats or sleeping space.

Commuter train service around such cities as Boston, Chicago, New York City, Philadelphia, and San Francisco also underwent a renaissance in the 1970s. Old cars were replaced, ridership increased, and most railroads were relieved of responsibility for operating deficits by public agencies.

Foreign Passenger Service

Leadership in the development of modern passenger trains has shifted away from the U.S. In 1965, Japanese National Railways inaugurated high-speed rail service on its electrified Tokaido line, serving industrial centers on the east coast of the main Japanese island of Honshu. By 1968 sixty 13-car trains made 160 trips each day over various distances on the 515-km (320-mi) route between Tokyo and Osaka, at speeds of 217 km/h (135 mph), and later extensions lengthened the route to 1136 km (706 mi), from Tokyo to Hakata.

In Europe, both France and Great Britain developed their own high-speed services. In 1981, French National Railways began running the train a grande vitesse, or TGV, between Paris and Lyon and between Paris and Geneva, at speeds of about 260 km/h (about 160 mph) or greater on routes that were built expressly for this service. British Rail, rather than build new routes for fast trains, developed the Advanced

Passenger Train (APT) to operate over existing tracks. The APT uses special tilting mechanisms that permit trains to negotiate curves at speeds of up to 210 km/h (about 130 mph)—far faster than conventional passenger trains are permitted to travel. After numerous delays because of problems with the train's stabilization system, service between London and Scotland began in 1984, by which time British Rail was already looking for a more satisfactory replacement.

Freight Cars and Service

Freight can be handled more economically in the U.S. and Canada than in most other countries because a high proportion of freight is moved in large units for long distances and can therefore be carried in long cars, which have a large capacity. The greater the capacity, the greater the ratio of the payload to the deadweight of the car; for example, a 14.6-m (48-ft) coal car weighing 27 metric tons can carry 77 tons of coal, but a 15.24-m (50-ft) car of similar construction, with a weight of 34 tons (23 percent more), can carry 109 tons of coal (41 percent more).

The aforementioned 77-ton and 109-ton coal cars are among the largest freight cars in general use. A 36- or 45-ton boxcar offers a striking contrast to the freight cars of 75 years ago, when the usual capacity was 9 or 14 tons. In Great Britain, where most freight is moved in small consignments on short hauls, most freight cars carry less than 14 tons. Most continental European freight cars are mounted on fixed wheels rather than on swiveling trucks and would be considered small or at best medium sized in the U.S. Large cars similar in most respects to American cars are used to a considerable extent, however, in the former Soviet Union, and also in India, Australia, Africa, and South America.

Besides boxcars, flatcars, and the open hopper or dump cars used for coal and ore, a variety of specially designed freight cars is made for particular purposes. Large semitrailers are carried piggyback on flatcars 24.4 m (80 ft) long. Refrigerated cars and, in freezing weather, heated cars, are needed for meat and other perishables. Special cars are provided for live poultry and livestock. Gases such as ammonia; liquids such as gasoline, oil, alcohol, acids, and paints; and also semiliquid or even solid products, including pickles, are often shipped in tank cars. The caboose, the small car that forms the tail end of a freight train, provides shelter and conveniences for the train crew. To permit the conductor to survey the entire train at intervals, the caboose usually has a glassed-in cupola projecting from the roof, but some recently built cabooses have bay windows instead.

Freight service is generally of two types. One type carries bulk commodities, such as coal, grain, or ore, and generally runs from origin to destination without switching, but on no set schedule. The other type of freight service operates on a regular schedule on a set route and carries all types of commodities. More and more railroads now operate trains containing only piggyback (trailer-on-flatcar) equipment on schedules almost as fast as passenger trains. By 1980 railroads were handling more than 3 million semitrailers or containers per year, and in commodity shipping, the number of piggyback loadings was exceeded only by coal.

Beginning in the 1960s railroads began allowing higher freight-train speeds—up to 112 km/h (70 mph) on some heavily used routes, although 80 km/h (50 mph) is more common. By the early 1980s, however, the industry had discovered that transit time could be shortened more easily by reducing the time that cars spent in yards than by raising speed limits en route, and most efforts to improve service took this new direction.

Advances in Rolling-Stock Design

Among the most important inventions of the 19th century were the air brake and the automatic coupler. Today most American rolling stock is equipped with air brakes (*see* Brake), which operate automatically if a coupling between cars breaks or if a leak develops in the compressed-air system. In the 1870s the American inventor Eli Hamilton Janney patented a design for couplers with pivoted knuckles that would interlock automatically when two cars were pushed together and that could be disengaged by means of a lever extending to the side of the car. In 1887 all car builders adopted as a standard a modified form of the Janney coupler. Because public resentment was aroused by the number of men crushed between cars when operating the old link-and-pin couplers by hand, a federal law was passed in 1897 requiring the installation of automatic couplers on all rolling stock. Enforcement was delayed by later legislation, but eventually this law became effective.

Early in the history of railroading, buffers on the ends of cars were introduced to minimize shocks when cars were bumped together. More modern designs make use of friction between two surfaces; on American passenger cars the head of the buffer at each end of the car is a horizontal plate that slides over or under a corresponding plate on the next car to form a connecting platform. In improved types of draft gears connecting couplers with car sills or underframes, sliding-friction devices have superseded springs.

An important 20th-century advance in rolling-stock design was the introduction of roller bearings, which replaced sleeve bearings on car axles *See* Bearing; almost all new rolling stock is now equipped with roller bearings.

Terminals and Yards

A terminal is an area where individual cars, perhaps arriving from various points, are sorted according to their destinations and assembled in trains. Freight and passenger terminals necessarily include not only stations with offices and various other facilities, but also yards with more or less elaborate systems of tracks and switches. Usually repair shops are provided, and passenger terminals usually include shops, yards, and sheds where cars are cleaned and supplies are put aboard sleeping cars and diners. An incoming locomotive, after its train is uncoupled in a receiving yard and drawn away by a switch engine, proceeds to the engine terminal for inspection, repairs, and servicing or storage. In a freight terminal, the train, minus its locomotive and caboose, is pushed into a classification yard where the cars are separated and sorted. On the usual level tracks the cars must be moved by switch engines, but a large and busy terminal may have a hump yard in which the cars are moved by

gravity. Newly assembled strings of cars proceed to other yards where they can be loaded or unloaded, repaired, stored, or prepared for departure.

6. HIGHER EDUCATION IN USA

Colorado State University, public, coeducational institution in Fort Collins, Colorado. The school was founded as the Agricultural College of Colorado in 1870, six years before Colorado became a state (*see* Colorado: *Statehood*). In 1879 the Colorado legislature designated the school a federal land-grant college. That year the institution also established the Colorado Agricultural Experiment Station, a center for agricultural research and education, and the Cooperative Extension, a statewide continuing-education program. Today both programs remain in operation. The school adopted the name Colorado State University in 1957.

Colorado State University confers bachelor's, master's, and doctoral degrees in the arts and sciences, humanities, the health professions, engineering, and environmental design. The school's programs in agricultural science, forestry, biochemistry, and business are particularly strong.

Colorado State University's main campus covers 170 hectares (421 acres). The school also maintains Pingree Park, a 482-hectare (1,192-acre) park that is used for conferences, environmental education, and summer camps. The park is located 89 km (55 mi) west of Fort Collins and borders Rocky Mountain National Park. Other facilities located off the main campus include an environmental learning center and an agriculture research development education center. Graduates of Colorado State University include Colorado Governor Roy Romer, astronaut Mary Clever, and actor Keith Carradine.

7. HIGHER EDUCATION IN GB

Education, Higher, period of advanced study following the completion of secondary education. The duration of the study may be from four to seven years or more, depending upon the nature and complexity of the programs pursued. The institution providing higher education may be either a college or university or a type of professional school. A junior or community college, such as those maintained by some state systems of higher education, offers a 2-year program of general education and/or technical training that serves either as terminal schooling or as preparation for more specialized study in a 4-year college or university. When the basic course of study is successfully completed, usually at the end of four years, the graduate receives a bachelor's degree. He or she may continue for a master's degree, generally requiring an additional year or two, and then for a doctorate, which normally requires the candidate to submit a dissertation and to complete a minimum of two or three years of further studies. Higher education, which usually includes some general education, is a time for specialized study to qualify the individual for professional activity or for employment in higher positions in business, industry, and government. In recent years, especially in the U.S., the trend has been toward requiring a greater number of courses common to all students in order to counteract a growing tendency toward overspecialization.

Aberdeen, University of, institution of higher learning, the first in Great Britain to train students in medicine, a field in which it has achieved special fame. The university, located in Aberdeen, Scotland, was incorporated in 1860, merging the College of Saint Mary, founded about 1495 and now called King's College, and Marischal College, established in 1593. However, it is not a collegiate university. Courses of instruction are offered in the arts, biological sciences, divinity, economic and social sciences, engineering and physical sciences, law, mathematics, and medicine. Students work toward a degree rather than in a specific department, which allows for greater flexibility in their choice of subjects. After a three-year ordinary or a four-year honors course of study, the university awards either the master of arts or the bachelor of science degree, approximately equivalent to the bachelor's degree in the United States. The university also awards graduate degrees of master (distinct from master of arts) and doctor.

8. BANKING SERVICES

Banking, transactions carried on by any individual or firm engaged in providing financial services to consumers, businesses, or government enterprises. In the broadest sense, a bank is a financial intermediary that performs one or more of the following functions: safeguards and transfers funds, lends or facilitates lending, guarantees creditworthiness, and exchanges money. These services are provided by such institutions as commercial banks, central banks, savings banks, trust companies, finance companies, life insurers, and investment bankers.

A narrower and more common definition of a bank is a financial intermediary that accepts, transfers, and, most important, creates deposits. This includes such depository institutions as central banks, commercial banks, savings and loan associations, and mutual savings banks.

Banks are most frequently organized in corporate form and are owned either by private individuals, governments, or a combination of private and government interests. Although noncorporate banks—that is, single proprietorships and partnerships—are found in other countries, since 1863 all federally chartered banks in the United States must be corporations. Only a few states permit formation of noncorporate banks. All countries subject their banks, however owned, to government regulation and supervision, normally implemented by central banking authorities.

Early Banking

Many banking functions such as safeguarding funds, lending, guaranteeing loans, and exchanging money can be traced to the early days of recorded history. In medieval times, the Knights Templars, a military and religious order, not only stored valuables and granted loans but also arranged for the transfer of funds from one country to another. The great banking families of the Renaissance, such as the Medicis in Florence (Italy), were involved in lending money and financing international trade. The first modern banks were established in the 17th century, notably the Riksbank in Sweden (1656) and the Bank of England (1694).

Seventeenth-century English goldsmiths provided the model for contemporary banking. Gold stored with these artisans for safekeeping was expected to be returned to the owners on demand. The goldsmiths soon discovered that the amount of gold actually removed by owners was only a fraction of the total stored. Thus, they could temporarily lend out some of this gold to others, obtaining a promissory note for principal and interest. In time, paper certificates redeemable in gold coin were circulated instead of gold. Consequently, the total value of these banknotes in circulation exceeded the value of the gold that was exchangeable for the notes.

Two characteristics of this fractional-reserve banking remain the basis for present-day operations. First, the banking system's monetary liabilities exceed its reserves. This feature was responsible in part for Western industrialization, and it still remains

important for economic expansion. The excessive creation of money, however, may lead to inflation. Second, liabilities of the banks (deposits and borrowed money) are more liquid—that is, more readily convertible to cash—than are the assets (loans and investments) included on the banks' balance sheets. This characteristic enables consumers, businesses, and governments to finance activities that otherwise would be deferred or cancelled; however, it underlies banking's recurrent liquidity crises. When too many depositors request payment, the banking system is unable to respond because it lacks sufficient liquidity. The lack of liquidity means that banks must either abandon their promises to pay depositors or pay depositors until the bank runs out of money and fails. The advent of deposit insurance in the United States in 1935 did much to alleviate the fear of deposit losses due to bank failure and has been primarily responsible for the virtual absence of runs on U.S. banks.

Commercial Banking in the U.S.

Commercial banks are the most significant of the financial intermediaries, accounting for some 60 percent of the nation's deposits and loans. The first bank to be chartered by the new federal government was the Bank of the United States, established in Philadelphia in 1791. By 1805 it had eight branches and served as the government's banker as well as the recipient of private and business deposits. The bank was authorized to issue as legal tender banknotes exchangeable for gold. Although the bank succeeded in establishing a sound national currency, its charter was not renewed in 1811 for political and economic reasons. The history of the second Bank of the United States (1816-36) repeated that of its predecessor. It served ably as the government's banker, achieved a sound national currency, and failed for political reasons when President Andrew Jackson vetoed charter renewal.

In the next three decades the number of banks grew rapidly in response to the flourishing economy and to the system of “free banking”—that is, the granting of a bank charter to any group that fulfilled stated statutory conditions. Government fiscal operations were handled initially by private bankers and later (after 1846) by the Independent Treasury System, a network of government collecting and disbursing offices. The Independent Treasury, however, could not cope with the financial demands of the American Civil War. Moreover, the multiplicity of state banks, each issuing its own banknotes, had resulted in a highly inefficient currency mechanism. The National Bank Act (1864) established the office of the comptroller of the currency to charter national banks that could issue national banknotes (this authority was not revoked until 1932). A uniform currency was achieved only after a tax on nonnational banknotes (1865) made their issuance unprofitable for the state-chartered banks. State banks survived by expanding their deposit-transfer function, continuing to this day a unique dual banking system, whereby a bank may obtain either a national or a state charter.

The stability hoped for by the framers of the National Bank Act was not achieved; banking crises occurred in 1873, 1883, 1893, and 1907, with bank runs and systemic bank failures. The Federal Reserve Act (1913) created a centralized reserve system that would act as a lender of last resort to forestall bank crises and would permit a more elastic currency to meet the needs of the economy. Reserve authorities,

however, could not prevent massive bank failures during the 1920s and early 1930s. *See* Federal Reserve System.

The Banking Acts of 1933 and 1935 introduced major reforms into the system and its regulatory mechanism. Deposit banking was separated from investment banking; the monetary controls of the Federal Reserve were expanded, and its powers were centralized in its Board of Governors; and the Federal Deposit Insurance Corporation (the FDIC, which now insures each depositor up to $100,000 per bank) was created. The banking system has continued to thrive, secure from widespread panics, and has expanded its services by developing alternative sources of funding and reaching out to new borrowers.

Commercial Banking Today

Loans account for over half of the total bank assets in the U.S. commercial banking system. Interest from these loans is a major source of bank income. Short-term loans to the most creditworthy borrowers usually are priced at the prime (interest) rate. Early in this century, such short-term financing to commercial enterprises was virtually the only type of loan commercial bankers would undertake. Today, bankers lend to businesses, consumers, and governments (both domestic and foreign), with maturities ranging from one day to several decades. In the late 1980s about 90 percent of the banking system's loans financed commercial and industrial enterprises, real-estate transactions, and consumer loans. The remaining loans were allocated to other financial intermediaries, to security dealers and brokers, and to foreign governments and official institutions. As a rule, the longer the maturity or the less creditworthy the borrower, the greater is the interest rate.

The second largest category of bank assets is investments, held by banks for both liquidity and income purposes. These investments include U.S. government and government guaranteed securities, the bonds of states and municipalities, and private securities. Banks also hold cash assets, mostly for liquidity purposes, but also because the banking authorities mandate that a certain fraction of deposits be held in cash-asset form.

Of the banking system's liabilities, about three-fourths are in the form of deposits, primarily from individuals and companies, but also from domestic and foreign government agencies. Since 1960, deposit composition has undergone a major shift, from a heavy concentration in demand deposits; by 1987, time and savings deposits exceeded demand deposits by more than a 3:1 ratio. Rising interest rates combined with changing banking practices go far to explain this reversal. Interest rates on assets comparable to time deposits in 1960 averaged 3.5 percent; in 1987 they averaged 7 percent. Bankers supplemented asset-management practices with management of liabilities; today, bankers are willing to acquire liabilities if the funds can be profitably lent out. Thus, beginning in the 1960s, new financial instruments such as large-denomination certificates of deposit were made available to depositors. As banks actively sought deposits in the United States and in Europe, the Eurodollar market was created, a market that was estimated to approach $1 trillion in the early

1980s. Nondeposit liabilities such as borrowings on the federal funds market, involving deposits with the Federal Reserve, were also pursued.

The largest banks account for the bulk of banking activity. In the late 1980s fewer than 5 percent of the commercial banks in the United States were responsible for more than 40 percent of all deposits, and 85 percent of the banks held less than one-fifth of total deposits. Competition for corporate and individual deposits is keen among the banking giants, whose growth is limited by the Bank Merger Act (1960) as well as by antitrust laws. The U.S. banking system differs radically in this respect from such countries as Canada, Great Britain, and Germany, where a handful of organizations dominate banking. In the past geographical constraints on expansion prevented banks from moving beyond their state or even beyond their county. Thus many small bankers were protected from competition. More recently most states as well as the federal government have loosened the regulation of banks, especially in the area of mergers and acquisitions. Many banks have grown by taking over other banks both within and outside their home states. In 1980 there were over 14,000 commercial banks in the United States; in the mid-1990s there were less than 11,000. Computer links among banks and the use of automated teller machines have broken down the geographical barriers to the growth of nationwide banking.

Overall government controls on banking were significantly loosened by the Depository Institutions Deregulation and Monetary Control Act (1980). Among its provisions are abolition of state usury limits on certain types of loans, gradual elimination of interest-rate ceilings on savings and time deposits, and extension of permission of all depository institutions to offer interest-paying checking accounts. The Garn-St. Germain Financial Institutions Act (1982), among its many other important provisions, permits interstate acquisition of failing banks.

While government regulation of commercial banking since the mid-1930s has led to a low failure rate and preserved a substantial amount of competition in some markets, local monopolies have also been implicitly encouraged. Moreover, stringent regulations have caused some bankers to devote considerable resources to circumventing government controls. The present rethinking of the role of government regulation in the economy in general may lead toward even further liberalization of controls over the banking system.

Thrift Institutions

Savings and loan associations (SLAs) and savings banks are similar but separate financial institutions. Both were patterned after cooperative movements in Scotland and England and, although they share the same roots, their different but related goals caused them to develop in different ways.

Historically, commercial banks ignored the nonbusiness sectors of the economy. This led to the evolution of a variety of thrift institutions designed specifically to serve the neglected consumer market. SLAs, which first appeared in the 1830s, were originally founded as “building societies” to provide their members with funds to buy or build a home. Today SLAs continue to concentrate on funding homes.

SLAs accept deposits from the public and use these funds to make various types of investments, mostly in residential real estate mortgages, and particularly in home mortgage loans. SLAs are the largest holders of mortgage debt in the U.S. The bulk of their liabilities are in the form of savings deposits. In the late 1980s the failures of many SLAs caused the government to overhaul the industry. SLAs are regulated by the Office of Thrift Supervision, an agency of the Treasury Department. Deposits in member institutions up to $100,000 are insured by the FDIC through its Savings Association Insurance Fund.

Savings banks were established to encourage thrift among working people and to provide a safe place for them to save. They pooled depositors' savings for investment and generally were restricted by charter to investing in government bonds. Their holdings in mortgage lending have grown from their early years, and by 1987, some 55 percent of their funds were invested in mortgage loans. A large part of their portfolios is held in stocks and bonds.

Mutual savings banks (MSBs) are found primarily on the eastern seaboard. Deposits in most MSBs are insured by the FDIC, including some MSBs that have converted to federal charters. The 1982 Garn-St. Germain Depository Institutions Act blurred many of the distinctions between SLAs and MSBs, permitting savings banks to convert to federal charters, and creating a new type of savings bank by allowing traditional SLAs to convert to savings banks. These new savings banks are federally chartered and are insured by the FDIC. Today SLAs, MSBs, and savings banks are all referred to generally as savings institutions.

The Garn-St. Germain Act expanded lending powers for savings institutions in the areas of consumer, commercial, and agricultural lending. These new authorities have allowed savings institutions to become full-service consumer financial centers. Savings institutions now offer a range of consumer loans, including automobile loans, home equity and home improvement loans, educational loans, trust services, and credit card purchases. Limited authority to make business loans was also part of the 1982 bill. Savings institutions also offer depositors checking accounts in the form of NOW accounts and Super NOW accounts, as well as a wide range of savings instruments, including insured money market accounts. As mandated by the Depository Institutions Deregulation and Monetary Control Act, all savings account interest rate ceilings and minimum balance requirements at savings institutions—and at commercial banks—were removed as of March 31, 1986.

On the lending side, the development of the adjustable rate mortgage (ARM), helps savings institutions match their incomes with their expenses. ARMs also function to keep housing affordable by offering borrowers lower initial interest rates on mortgage loans. An ARM loan permits adjustments in the interest rate or payment at specific intervals, based on the movement of an independent index reflecting economic conditions. Even with their expanded powers, the primary focus of savings institutions remains real estate lending, particularly home mortgages. *See Also* Credit Union.

European Banking

Significant structural differences distinguish the U.S. banking system from that of developed nations. The main differences are in ownership, scope and concentration of activities, and the giro system of banking.

Virtually all banking institutions in the U.S., as well as Canada and Great Britain, are privately owned. In France and Italy, however, the government either owns the major commercial banks or the majority of their stock.

European banks engage in some activities prohibited to banks in the U.S., such as the placement and acquisition of common stock. Commercial banks in Europe tend to be more business oriented and limit their lending to shorter-term loans. Long-term loans are handled by bank affiliates. The share of the deposits and loans handled by the major European banks tends to be considerably larger than that handled by their U.S. counterparts. This stems from the absence of restrictions on branching, leading the large European banks to maintain extensive networks of branches in their home countries. The absence of an antitrust tradition also accounts for the greater degree of concentration.

A common system of arranging consumer payments in Europe is the use of giro accounts. In a giro transaction, the payer will order the giro bank to pay specific sums to a number of payees. The payer's account is debited, and the payees' accounts are credited.

Banking in Great Britain

Since the 17th century Great Britain has been known for its prominence in banking. London still remains a major financial center, and virtually all the world's leading commercial banks are represented there.

Aside from the Bank of England, which was incorporated, early English banks were privately owned rather than stock-issuing firms. Bank failures were common; so in the early 19th century, joint-stock banks, with a larger capital base, were encouraged as a means of stabilizing the industry. By 1833 these corporate banks were permitted to accept and transfer deposits in London, although they were prohibited from issuing banknotes, a monopoly prerogative of the Bank of England. Corporate banking flourished after legislation in 1858 approved limited liability for joint-stock companies. The banking system, however, failed to preserve the large number of institutions typical of U.S. banking. At the turn of this century, a wave of bank mergers reduced both the number of private and joint-stock banks.

The present structure of British commercial banking was substantially in place by the 1930s, with the Bank of England, then privately owned, at the apex, and 11 London clearing banks ranked below. Two changes have occurred since then: The Bank of England was nationalized in 1946 by the postwar Labour government; and in 1968 a merger among the largest five clearing banks left the industry in the hands of four (Barclays, Lloyds, Midland, and National Westminster).

The larger clearing banks, with their national branch networks, dominate British banking. They are the key links in the transfer of business payments through the checking system, as well as the primary source of short-term business finance.

Moreover, through their ownership and control over subsidiaries, the big British banks influence other financial markets dealing with consumer and housing finance, merchant banking, factoring, and leasing. The dominance of the clearing banks was challenged in recent years by the rise of “parallel markets,” encompassing financial activities by smaller banking houses, building societies (similar to SLAs in the United States), and other financial concerns, as well as local government authorities. The major banks responded to this competition by offering new services and competitive terms.

A restructuring in the banking industry took place in the late 1970s. The Banking Act of 1979 formalized Bank of England control over the British banking system, previously supervised on an informal basis. Only institutions approved by the Bank of England as “recognized banks” or “licensed deposit-taking institutions” are permitted to accept deposits from the public. The act also extended Bank of England control over the new financial intermediaries that have flourished since 1960.

London has become the center of the Eurodollar market; participants include financial institutions from all over the world. This market, which began in the late 1950s and grew in some 25 years to an estimated volume of $1 trillion, borrows and lends dollars and other currencies outside the currency's home country (for example, franc accounts held in any country other than France).

Banking in Developing Countries

The type of national economic system that characterizes developing countries plays a crucial role in determining the nature of the banking system. In capitalist countries a system of private enterprise in banking prevails. In a number of socialist countries (for example, Egypt and Sudan) all banks have been nationalized. Other countries have patterned themselves after the liberal socialism of Europe; in Peru and Kenya, for instance, government-owned and privately owned banks coexist. In many countries, the banking system developed under colonialism, with banks owned by institutions in the parent country. In some, such as Zambia and Cameroon, this heritage continued, although modified, after decolonization. In other nations, such as Nigeria and Saudi Arabia, the rise of nationalism led to mandates for majority ownership by the indigenous population.

Banks in developing countries are similar to their counterparts in developed nations. Commercial banks accept and transfer deposits and are active lenders, especially for short-term purposes. Other financial intermediaries, particularly government-owned development banks, arrange long-term loans. Banks are often used to finance government expenditures. The banking system may also play a major role in financing exports.

In the poorer countries, an extensive but primitive nonmonetary sector usually continues to exist. It is the special task of the banking community to encourage the use of money and instill banking habits among the population.

Role of Central Banking

The foremost monetary institution in a market economy is the central bank. These are usually government-owned institutions, but even in countries where they are owned by the nation's banks (such as the United States and Italy), the responsibility of the central bank is to the national interest.

Most central banks perform the following functions: They serve as the government's banker, act as the banker of the banking system, regulate the monetary system for both domestic and international policy goals, and issue the nation's currency. As banker to the government, the central bank collects and disburses government income and receipts, manages the issue and redemption of government debt, advises the government on all matters pertaining to financial activities, and makes loans to the government. As banker to the nation's banks, the central bank holds and transfers banks' deposits, supervises their operations, acts as a lender of last resort, and provides technical and advisory services. Monetary policy for both domestic and foreign purposes is implemented and, in many countries, decided by the national banking authorities, using a variety of direct and indirect controls over the financial institutions. Coins and notes that circulate as the national currency are usually the liability of the central bank.

The ability of the central bank to control the money supply and thus the pace of economic growth is responsible for a major economic-policy debate. Some economists believe that monetary control is extremely effective in the short run and can be used to influence economic activity. Nevertheless, some hold that discretionary monetary policy should not be used because, in the long run, central banks have been unable to control the economy effectively. Another group of economists believes that the short-run impact of monetary control is less powerful, but that the central banking authorities can play a useful role in mitigating the excesses of inflation and depression. A newer school of economists claims that monetary policy cannot affect systematically the pace of national economic activity. All agree that problems related to the supply side of the economy, such as fuel shortages, cannot be resolved by central-bank action.

International Banking

The expansion of trade in recent decades has been paralleled by the growth of multinational banking. Banks have historically financed international trade, but the notable recent development has been the expansion of branches and subsidiaries that are physically located abroad, as well as the increased volume of loans to foreign borrowers. In 1960 only 8 U.S. banks had foreign offices. By 1987, about 150 U.S. banks had about 900 foreign branches.

Similarly, the number of foreign banks with offices in the United States increased almost three-fold during the 1970s and 1980s. Most of these banks are business-oriented banks, but some have also engaged in retail banking. In 1978 the U.S. Congress passed the International Banking Act, which imposed constraints on the activities of foreign banks in the United States, removing some of the advantages they had acquired in relation to U.S. banks. Foreign banks have also penetrated the American market by acquiring ownership of existing banks.

The growth of the Eurodollar market has forced major U.S. banks to operate branches not only in Europe but also in Asia. The world's banking system played a key role in the recycling of petrodollars, arising from the surpluses of the oil-exporting countries and the deficits of the oil-importing nations. This activity, while it smoothed international financial arrangements, is currently proving worrisome as foreign debtors find it more difficult to repay outstanding loans.

9. NATURE PROTECTION

Pollution, contamination of the earth's environment with materials that interfere with human health, the quality of life, or the natural functioning of *ecosystems* (living organisms and their physical surroundings). Although some environmental pollution is a result of natural causes like volcanic eruptions, most is caused by human activities.

There are two main categories of polluting materials, or pollutants. *Biodegradable pollutants* are materials, such as sewage, that rapidly decompose by natural processes. These pollutants become a problem when added to the environment faster than they can decompose (*see* Sewage Disposal). *Nondegradable* pollutants are materials that either do not decompose or decompose slowly in the natural environment. Once contamination occurs, it is difficult or impossible to remove these pollutants from the environment.

Nondegradable compounds like dichlorodiphenyltrichloroethane (DDT), dioxins, polychlorinated biphenyls (PCBs), and radioactive materials can reach dangerous levels of accumulation as they are passed up the food chain into the bodies of progressively larger animals. For example, molecules of toxic compounds may collect on the surface of aquatic plants without doing much damage to the plants. A small fish that grazes on these plants accumulates a high concentration of the toxin. Larger fish or other carnivores that eat the small fish will accumulate even greater, and possibly life-threatening, concentrations of the compound. This process is known as bioaccumulation.

Impacts of Pollution

Because humans are at the top of the food chain, they are particularly vulnerable to the effects of nondegradable pollutants. This was clearly illustrated in the 1960s and 1970s when residents living near Minimata Bay, Japan, developed nervous disorders, tremors, and paralysis in a mysterious epidemic. Over 400 people died before authorities discovered that a local industry had released mercury into Minimata Bay. This highly toxic element accumulated in the bodies of local fish and eventually in the bodies of people who consumed the fish. More recently research has revealed that many chemical pollutants, such as DDT and PCBs, mimic sex hormones and interfere with the human body's reproductive and developmental functions. These substances are known as endocrine disrupters. *See* Occupational and Environmental Diseases.

Pollution also has a dramatic effect on natural resources. Ecosystems such as forests, wetlands, coral reefs, and rivers perform many important services for the earth's environment. They enhance water and air quality, provide habitat for plants and animals, and provide food and medicines. Any or all of these ecosystem functions

may be impaired or destroyed by pollution. Moreover, because of the complex relationships among the many types of organisms and ecosystems, environmental contamination may have far-reaching consequences that are not immediately obvious or that are difficult to predict. For instance, scientists can only speculate on some of the potential impacts of the depletion of the ozone layer, the protective layer in the atmosphere that shields the earth from the sun's harmful ultraviolet rays.

Another major effect of pollution is the tremendous cost of pollution cleanup and prevention. The global effort to control emissions of carbon dioxide, a gas produced from the combustion of fossil fuels such as coal or oil, or of other organic materials like wood, is one such example. The cost of maintaining annual national carbon dioxide emissions at 1990 levels is estimated to be 2 percent of the gross domestic product for developed countries. Expenditures to reduce pollution in the United States in 1993 totaled $109 billion, including $105.4 billion on reduction, $1.9 billion on regulation, and $1.7 billion on research and development. Twenty-nine percent of the total cost went toward air pollution, 36 percent to water pollution, and 36 percent to solid waste management.

In addition to its effects on the economy, health, and natural resources, pollution has social implications. Research has shown that low-income populations and minorities do not receive the same protection from environmental contamination as do higher-income communities. Toxic waste incinerators, chemical plants, and solid waste dumps are often located in low-income communities because of a lack of organized, informed community involvement in municipal decision-making processes.

Types of Pollution

Pollution exists in many forms and affects many different aspects of the earth's environment. *Point-source* pollution comes from specific, localized, and identifiable sources, such as sewage pipelines or industrial smokestacks. *Nonpoint-source* pollution comes from dispersed or uncontained sources, such as contaminated water runoff from urban areas or automobile emissions.

The effects of these pollutants may be immediate or delayed. *Primary* effects of pollution occur immediately after contamination occurs, such as the death of marine plants and wildlife after an oil spill at sea. *Secondary* effects may be delayed or may persist in the environment into the future, perhaps going unnoticed for many years. DDT, a nondegradable compound, seldom poisons birds immediately, but gradually accumulates in their bodies. Birds with high concentrations of this pesticide lay thin-shelled eggs that fail to hatch or produce deformed offspring. These secondary effects, publicized by Rachel Carson in her 1962 book, *Silent Spring*, threatened the survival of species such as the bald eagle and peregrine falcon, and aroused public concern over the hidden effects of nondegradable chemical compounds.

Air Pollution

Human contamination of the earth's atmosphere can take many forms and has existed since humans first began to use fire for agriculture, heating, and cooking.

During the Industrial Revolution of the 18th and 19th centuries, however, air pollution became a major problem. As early as 1661 British author and founding member of the British Royal Society John Evelyn reported of London in his treatise *Fumifugium*, "...the weary Traveller, at many Miles distance, sooner smells, than sees the City to which he repairs. This is that pernicious Smoake which fullyes all her Glory, superinducing a sooty Crust or Furr upon all that it lights..."

Urban air pollution is commonly known as smog. The dark London smog that Evelyn wrote of is generally a smoky mixture of carbon monoxide and organic compounds from incomplete combustion (burning) of fossil fuels such as coal, and sulfur dioxide from impurities in the fuels. As the smog ages and reacts with oxygen, organic and sulfuric acids condense as droplets, increasing the haze. Smog developed into a major health hazard by the 20th century. In 1948, 19 people died and thousands were sickened by smog in the small U.S. steel mill town of Donora, Pennsylvania. In 1952, 2000 Londoners died of its effects.

A second type of smog, *photochemical* smog, began reducing air quality over large cities like Los Angeles in the 1930s. This smog is caused by combustion in car, truck, and airplane engines, which produce nitrogen oxides and release hydrocarbons from unburned fuels. Sunlight causes the nitrogen oxides and hydrocarbons to combine and turn oxygen into ozone, a chemical agent that attacks rubber, injures plants, and irritates lungs. The hydrocarbons are oxidized into materials that condense and form a visible, pungent haze.

Eventually most pollutants are washed out of the air by rain, snow, fog, or mist, but only after traveling large distances, sometimes across continents. As pollutants build up in the atmosphere, sulfur and nitrogen oxides are converted into acids that mix with rain. This acid rain falls in lakes and on forests, where it can lead to the death of fish and plants, and damage entire ecosystems. Eventually the contaminated lakes and forests may become lifeless. Regions that are downwind of heavily industrialized areas, such as Europe and the eastern United States and Canada, are the hardest hit by acid rain. Acid rain can also affect human health and man-made objects; it is slowly dissolving historic stone statues and building facades in London, Athens, and Rome.

One of the greatest challenges caused by air pollution is global warming, an increase in the earth's temperature due to the buildup of atmospheric gases such as carbon dioxide. With the heavy use of fossil fuels in the 20th century, atmospheric concentrations of carbon dioxide have risen dramatically. Carbon dioxide and other gases, known as *greenhouse gases*, reduce the escape of heat from the planet without blocking radiation coming from the sun. Because of this greenhouse effect, average global temperatures are expected to rise 1° to 3.5° C (1.8° to 6.3° F) by the year 2100. Although this trend appears to be a small change, the increase would make the earth warmer than it has been in the last 125,000 years, possibly changing climate patterns, affecting crop production, disrupting wildlife distributions, and raising the sea level.

Air pollution can also damage the upper atmospheric region known as the stratosphere. Excessive production of chlorine-containing compounds such as chlorofluorocarbons (CFCs) (compounds used in refrigerators, air conditioners, and in the manufacture of polystyrene products) has depleted the stratospheric ozone layer, creating a hole above Antarctica that lasts for several weeks each year. As a result, exposure to the sun's harmful rays has damaged aquatic and terrestrial wildlife and threatens human health in high-latitude regions of the northern and southern hemispheres.

Water Pollution

The demand for freshwater rises continuously as the world's population grows. From 1940 to 1990, withdrawals of fresh water from rivers, lakes, reservoirs, and other sources has increased fourfold. Of the water consumed each year, 69 percent is used for agriculture, 23 percent for industry, and 8 percent for domestic uses.

Sewage, industrial wastes, and agricultural chemicals such as fertilizers and pesticides are the main causes of water pollution. In 1995, the U.S. Environmental Protection Agency (EPA) reported that about 37 percent of the country's lakes and estuaries, and 36 percent of its rivers, are too polluted for basic uses such as fishing or swimming, during all or part of the year. In developing nations, over 95 percent of urban sewage is discharged untreated into rivers and bays, creating a major human health hazard.

Water runoff, a nonpoint source of pollution, carries fertilizing chemicals such as phosphates and nitrates from agricultural fields and yards into lakes, streams, and rivers. These combine with the phosphates and nitrates from sewage to speed the growth of algae, a type of aquatic plant. The water body may then become choked with decaying algae, which severely depletes the oxygen supply. This process, called eutrophication, can cause the death of fish and other aquatic life. Runoff also carries toxic pesticides and urban and industrial wastes into lakes and streams.

Erosion, the wearing away of topsoil by wind and rain, also contributes to water pollution. Soil and silt (a fine sediment) washed from logged hillsides, plowed fields, or construction sites, can clog waterways and kill aquatic vegetation. Even small amounts of silt can eliminate desirable fish species. For example, when logging removes the protective plant cover from hillsides, rain may wash soil and silt into streams, covering the gravel beds that trout or salmon use for spawning.

The marine fisheries supported by ocean ecosystems are an essential source of protein, particularly for people in developing countries; approximately 950 million people worldwide consume fish as their primary source of protein. Yet pollution in coastal bays, estuaries, and wetlands threatens fish stocks already depleted by overfishing. In 1989, 260,000 barrels of oil was spilled from the oil tanker *Exxon Valdez* into Alaska's Prince William Sound, a pristine and rich fishing ground. In 1992 there were 8790 reported spills in and around U.S. waters, involving 5.7 million liters (1.5 million gallons) of oil.

Soil Pollution

Soil is a mixture of mineral, plant, and animal materials that forms during a long process that may take thousands of years. It is necessary for most plant growth and is essential for all agricultural production. Soil pollution is a buildup of toxic chemical compounds, salts, pathogens (disease-causing organisms), or radioactive materials that can affect plant and animal life.

Unhealthy soil management methods have seriously degraded soil quality, caused soil pollution, and enhanced erosion. Treating the soil with chemical fertilizers, pesticides, and fungicides interferes with the natural processes occurring within the soil and destroys useful organisms such as bacteria, fungi, and other microorganisms. For instance, strawberry farmers in California fumigate the soil with methyl bromide to destroy organisms that may harm young strawberry plants. This process indiscriminately kills even beneficial microorganisms and leaves the soil sterile and dependent upon fertilizer to support plant growth. This results in heavy fertilizer use and increases polluted runoff into lakes and streams.

Improper irrigation practices in areas with poorly drained soil may result in salt deposits that inhibit plant growth and may lead to crop failure. In 2000 BC, the ancient Sumerian cities of the southern Tigris-Euphrates Valley in Mesopotamia depended on thriving agriculture. By 1500 BC, these cities had collapsed largely because of crop failure due to high soil salinity. The same soil pollution problem exists today in the Indus Valley in Pakistan, the Nile Valley in Egypt, and the Imperial Valley in California.

Solid Waste

Solid wastes are unwanted solid materials such as garbage, paper, plastics and other synthetic materials, metals, and wood. Billions of tons of solid waste are thrown out annually. The United States alone produces about 200 million metric tons of municipal solid waste each year (*see*Solid Waste Disposal). A typical American generates an average of four pounds of solid waste each day. Cities in economically developed countries produce far more solid waste per capita than those in developing countries. For instance, Washington D.C. produces five times the solid waste, per person, of Quito, Ecuador. Moreover, waste from developed countries typically contains a high percentage of synthetic materials that take longer to decompose than the primarily biodegradable waste materials of developing countries.

Areas where wastes are buried, called landfills, are the cheapest and most common disposal method for solid wastes worldwide. But landfills quickly become overfilled and may contaminate air, soil, and water. *Incineration*, or burning, of waste reduces the volume of solid waste, but produces dense ashen wastes (some of which become airborne) that often contain dangerous concentrations of hazardous materials such as heavy metals and toxic compounds. *Composting*, using natural biological processes to speed the decomposition of organic wastes, is an effective strategy for dealing

with organic garbage and produces a material that can be used as a natural fertilizer. *Recycling*, extracting and reusing certain waste materials, has become an important part of municipal solid waste strategies in developed countries. According to the EPA, over one-fifth of the municipal solid waste produced in the United States is now recycled or composted. Recycling also plays a significant, informal role in solid waste management for many Asian countries, such as India, where organized waste-pickers comb streets and dumps for items such as plastics, which they use or resell.

Expanding recycling programs worldwide can help reduce solid waste pollution, but the key to solving severe solid waste problems lies in reducing the amount of waste generated. *Waste prevention*, or source reduction, such as altering the way products are designed or manufactured to make them easier to reuse, reduces the high costs associated with environmental pollution.

Hazardous Waste

Hazardous wastes are solid, liquid, or gas wastes that may be deadly or harmful to people or the environment and tend to be persistent or nondegradable in nature. Such wastes include toxic chemicals and flammable or radioactive substances, including industrial wastes from chemical plants or nuclear reactors, agricultural wastes such as pesticides and fertilizers, medical wastes, and household hazardous wastes such as toxic paints and solvents.

About 400 million metric tons of hazardous wastes are generated each year. The United States alone produces 240 million metric tons--70 percent from the chemical industry. The use, storage, transportation, and disposal of these substances pose serious environmental and health risks. Even brief exposure to some of these materials can cause cancer, birth defects, nervous system disorders, and death. Large-scale releases of hazardous materials may cause thousands of deaths and contaminate air, water, and soil for many years. The world’s worst nuclear reactor accident took place in Chernobyl, Ukraine, in 1986. The accident killed at least 31 people, forced the evacuation of over 100,000 more, and sent a plume of radioactive material into the atmosphere that contaminated areas as far away as Norway and Great Britain.

Until the Minimata Bay contamination was discovered in Japan in the 1960s and 70s, most hazardous wastes were legally dumped in solid waste landfills, buried, or dumped into lakes, rivers, and oceans. Legal regulations now restrict how such materials may be used or disposed, but such laws are difficult to enforce and often contested by industry. It is not uncommon for industrial firms in developed countries to pay poorer countries to accept shipments of solid and hazardous wastes, a practice that has become known as the waste trade. Moreover, cleaning up the careless dumping of the mid-20th century is costing billions of dollars and progressing very slowly, if at all. The United States has an estimated 10,000 abandoned hazardous waste dumps that need immediate action. Cleaning them up could take 50 years and cost $100 billion.

Hazardous wastes of particular concern are the radioactive wastes from the nuclear power and weapons industries. To date there is no safe method for permanent

disposal of old fuel elements from nuclear reactors. Most are kept in storage facilities at the original reactor sites where they were generated. With the end of the Cold War, nuclear warheads that are *decommissioned*, or no longer in use, also pose storage and disposal problems.

Noise Pollution

Unwanted sound, or noise, such as that produced by airplanes, traffic, or industrial machinery, is considered a form of pollution. Noise pollution is at its worst in densely populated areas. It can cause hearing loss, stress, high blood pressure, sleep loss, distraction, and lost productivity.

Sounds are produced by objects that vibrate at a rate that the ear can detect. This rate is called frequency and is measured in *hertz*, or vibrations per second. Most humans can hear sounds between 20 and 20,000 hertz, while dogs can hear high-pitched sounds up to 50,000 hertz. While high-frequency sounds tend to be more hazardous and more annoying to hearing than low-frequency sounds, most noise pollution damage is related to the *intensity* of the sound, or the amount of energy it has. Measured in decibels, noise intensity can range from zero, the quietest sound the human ear can detect, to over 160 decibels. Conversation takes place at around 40 decibels, a subway train is about 80 decibels, and a rock concert is from 80 to 100 decibels. The intensity of a nearby jet taking off is about 110 decibels. The threshold for pain, tissue damage, and potential hearing loss in humans is 120 decibels. Long-lasting, high-intensity sounds are the most damaging to hearing and produce the most stress in humans.

Solutions to noise pollution include adding insulation and sound-proofing to doors, walls, and ceilings; using ear protection, particularly in industrial working areas; planting vegetation to absorb and screen out noise pollution; and zoning urban areas to maintain a separation between residential areas and zones of excessive noise.

History

Much of what we know of ancient civilizations comes from the wastes they left behind. Refuse such as animal skeletons and implements from stone age cave dwellings in Europe, China, and the Middle East helps to reveal hunting techniques, diet, clothing, tool usage, and the use of fire for cooking. Prehistoric refuse heaps, or *middens*, discovered by archeologists in coastal areas of North America reveal information about the shellfish diet and eating habits of Native Americans who lived over 10,000 years ago.

As humans developed new technologies, the magnitude and severity of pollution increased. Many historians speculate that the extensive use of lead plumbing for drinking water in Rome caused chronic lead poisoning in those who could afford such plumbing. The mining and smelting of ores that accompanied the transition from the Stone Age to the Metal Age resulted in piles of mining wastes that spread potentially toxic elements such as mercury, copper, lead, and nickel throughout the environment.

Evidence of pollution during the early Industrial Revolution is widespread. Samples of hair from historical figures such as Newton and Napoleon show the presence of toxic elements such as antimony and mercury. By the 1800s, certain trades were associated with characteristic occupational diseases: Chimney sweeps contracted cancer of the *scrotum* (the external sac of skin enclosing the testes, or reproductive glands) from hydrocarbons in chimney soot; hatters became disoriented, or "mad," from nerve-destroying mercury salts used to treat felt fabric; and bootblacks suffered liver damage from boot polish solvents.

During the 20th century, pollution evolved from a mainly localized problem to one of global consequences in which pollutants not only persisted in the environment, but changed atmospheric and climatic conditions. The Minimata Bay disaster was the first major indication that humans would need to pay more attention to their waste products and waste disposal practices, in particular, hazardous waste disposal. In the years that followed, many more instances of neglect or carelessness resulted in dangerous levels of contamination. In 1976 an explosion at a chemical factory in Seveso, Italy, released clouds of toxic dioxin into the area, exposing hundreds of residents and killing thousands of animals that ate exposed food. In 1978 it was discovered that the Love Canal housing development in New York state was built on a former chemical waste dump. The development was declared uninhabitable. The world's worst industrial accident occurred in Bhopal, India in 1984. A deadly gas leaked from an American chemical plant, killing over 2000 people while injuring over 200,000.

The 1986 Chernobyl nuclear reactor accident demonstrated the dangerous contamination effects of large, uncontained disasters. In an unprecedented action, pollution was used as a military tactic in 1991 during the conflict in the Persian Gulf. The Iraqi military intentionally released as much as 1 billion liters (336 million gallons) of crude oil into the Persian Gulf and set fire to over 700 oil wells, sending thick, black smoke into the atmosphere over the Middle East.

Controlling Pollution

Because of the many environmental tragedies of the mid-20th century, many nations instituted new, comprehensive regulations designed to repair the past damage of uncontrolled pollution and prevent future environmental contamination. In the United States, the Clean Air Act (1970) and its amendments significantly reduced certain types of air pollution, such as sulfur dioxide emissions. The Clean Water Act (1977) and Safe Drinking Water Act (1974) regulated pollution discharges and set water quality standards. The Toxic Substances Control Act (1976) and the Resource Conservation and Recovery Act (1976) provided for the testing and control of toxic and hazardous wastes. In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, to provide funds to clean up the most severely contaminated hazardous waste sites. These and several other federal and state laws helped limit uncontrolled pollution, but progress has been slow and many severe contamination problems remain due to lack of funds for cleanup and enforcement.

International agreements have also played a role in reducing global pollution. The Montreal Protocol on Substances that Deplete the Ozone Layer (1987) set international target dates for reducing the manufacture and emissions of the chemicals, such as CFCs, known to deplete the ozone layer. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989), serves as a framework for the international regulation of hazardous waste transport and disposal.

Regulations and legislation have led to considerable progress in cleaning up air and water pollution in developed countries. Vehicles in the 1990s emit fewer nitrogen oxides than those in the 1970s did; power plants now burn low-sulfur fuels; industrial stacks have scrubbers to reduce emissions; and lead has been removed from gasoline. Developing countries, however, continue to struggle with pollution control because they lack clean technologies and desperately need to improve economic strength, often at the cost of environmental quality. The problem is compounded by developing countries attracting foreign investment and industry by offering cheaper labor, cheaper raw materials, and fewer environmental restrictions. The *maquiladoras,* assembly plants along the Mexican side of the Mexico-U.S. border, provide jobs and industry for Mexico, but are generally owned by non-Mexican corporations attracted to the cheap labor and lack of pollution regulation. As a result, this border region, including the Rio Grande river, is one of the most heavily polluted zones in North America. To avoid ecological disaster and increased poverty, developing countries will require aid and technology from outside nations and corporations, community participation in development initiatives, and strong environmental regulations.

Nongovernmental citizen groups have formed at the local, national, and international level to combat pollution problems worldwide. Many of these organizations provide information and support for people or organizations traditionally not involved in the decision-making process. The Pesticide Action Network provides technical information about the effects of pesticides on farmworkers. The Citizen's Clearinghouse for Hazardous Waste, established by veterans of the Love Canal controversy, provides support for communities targeted for hazardous waste installations. A well-organized, grassroots, environmental justice movement has arisen to advocate equitable environmental protections. Greenpeace International is an activist organization that focuses international attention on industries and governments known to contaminate land, sea, or atmosphere with toxic or solid wastes. Friends of the Earth International is a federation of international organizations that fight environmental pollution around the world.

10. CUSTOMS SYSTEM

Customs Service, United States, formerly Bureau of Customs, agency of the U.S. Treasury Department, created in 1789 to administer and enforce the tariff and other related laws and thus provide revenue for the country. The service is directed by a commissioner of customs and comprises seven regions, each administered by a regional commissioner of customs. The regions are subdivided into 44 customs districts in the United States, Puerto Rico, and the Virgin Islands, including approximately 240 customs ports and stations. More than a dozen offices also function in foreign countries.

The service assesses and collects import duties and taxes; regulates carriers, persons, and merchandise entering or departing from the U.S.; detects and prevents smuggling and frauds; administers certain navigation laws; and works to suppress traffic in illegal narcotics. It also informs import-export businesses of laws, regulations, and controls concerning international trade established by customs and other government agencies and encourages voluntary compliance with them.

11. HOTEL SERVICES

Hotel, commercial establishment that provides lodging, food, and other services to the public. The hotel business is an important industry in many countries, especially in those attracting a large tourist trade. Hotels can be classified according to location, facilities and services offered, and clientele served.

Hotels for Travelers

The transient hotel is usually located within city boundaries and caters to people traveling for business or pleasure. Motor hotels or motels cater to the same group of persons, but are often situated near or along major highways. Both hotels and motels provide numerous amenities in addition to sleeping accommodations, including maid service, radio and television, parking space for automobiles, recreational facilities, food and beverage services, and retail shops.

Convention Facilities

Conventions are the most important source of income for some hotels and motels. In the U.S., for example, it is estimated that some 10 million people attend conventions each year. Conventions assure a steady income both from sleeping accommodations and from meeting rooms, which are used for conferences and lectures. Dining facilities are the source of additional revenue through the sale of food and beverages. Local residents also use the catering services, meeting rooms, and ballrooms for social functions and business meetings.

Resorts

Resort hotels and motels usually are located in seaside, lake, or mountain areas, and they cater to tourists and vacationers. Resorts provide all hotel services plus recreational and athletic activities. In recent years, the hotel industry has experienced tremendous growth as a result of the increase in tourism in resort areas such as the Caribbean islands, the Mediterranean region, and Hawaii. With the growing popularity of winter vacations, many resorts have become year-round institutions. In cold climates skiing and other winter sports are enjoyed by vacationers. Conventions help to assure off-season occupancy of resort properties.

Residential Hotels

The residential hotel caters to permanent residents rather than to travellers. These hotels are similar to apartment buildings except that they provide maid and valet service, and often have dining facilities. Lodgings are available on a weekly, monthly, or yearly basis.

12. SHOPS AND SERVICES

Department Stores, large retail stores selling many different kinds of merchandise arranged in separate departments. Such stores are found in nearly every important city in the world, and the large department stores often contain more than 100 separate departments. The two major categories of merchandise sold in department stores generally are apparel and home furnishings. Besides making many diverse items available for purchase in one place, department stores offer numerous services, including delivery and mailing of purchases; credit service, usually in the form of charge accounts; and fashion shows.

The organization of a modern department store is often complex because of the large number of goods and services provided. Typically, the operation of a store is conducted through five principal divisions: the merchandising division, responsible for the buying and pricing of merchandise; the sales promotion division, in control of advertising, display, public relations, and other related matters; the personnel division, which supervises employment and the training and welfare of employees; the operations division, responsible for customer and selling services, for deliveries, and for the receiving, marking, and maintenance of merchandise; and the finance and control division, which deals with accounting, customer credit, expense control, and other financial and budgetary matters. Within these five divisions are many subdivisions. The heads, or managers, of the five principal divisions are responsible to the general manager.

Some stores find it practicable to lease certain areas within the premises to outside concerns, which then run their own departments under the name of the department store. This arrangement is most frequently used for such specialized goods or services as millinery, photographic supplies, shoe repair, and beauty salons.

Chain Stores

Since the 1920s an increasing number of department stores have been combined into chain organizations, or ownership groups, with varying degrees of central control

over individual stores (*see* Chain Stores). In some cases these organizations came about through mergers of long-established stores, which retained their own names. In other instances, they developed through the creation of new stores by an original parent organization. Two of the largest chains, Sears, Roebuck & Company and Montgomery Ward & Company, both founded in Chicago in the latter part of the 19th century, were also notable as mail-order houses, publishing large illustrated catalogs from which the public could order merchandise directly by mail. Both firms originally served principally rural communities. Following World War I, they opened retail outlets, which numbered in the hundreds by the late 1980s; Montgomery Ward and Sears stopped distributing catalogs in 1985 and 1993, respectively. A third major department store chain, J. C. Penney, not only offered retail and catalog sales but also operated a home-shopping channel on cable television. Two other chains, Wal-Mart and K Mart, showed significant sales growth during the 1980s.

Other famous names included Abraham & Straus, Bloomingdale's, Filene's, Jordan Marsh, Neiman-Marcus, and Saks Fifth Avenue. Many had branches in large cities and suburban shopping malls. As the economy slumped in 1990, some of these stores experienced hardships, in part because the holding companies that controlled them were saddled with debt.

Suburban Branches

The growth of suburbs around large cities has been responsible for an important department store development, the opening of suburban branches. The first such branch was established in 1930 in Ardmore, Pennsylvania, by Strawbridge & Clothier of Philadelphia; many other department stores subsequently followed its example, and suburban branch stores are numerous today.

Suburban branches often are grouped together in a shopping center, an aggregation of retail outlets coordinated for the convenience of customers and the mutual advantage of the stores. The suburban branch is not operated as an exact counterpart of the parent store. The merchandise, for example, is selected to meet the needs, tastes, and desired price ranges of customers located within a particular trading area.

Limited Service Policy

More recent methods adopted in many department stores include the self-selection of merchandise by customers and a cash-and-carry policy. Both methods are designed to reduce operating expenses. In some stores that have adopted the cash-and-carry policy, delivery services have been eliminated altogether. In many stores an extra fee is charged for delivery service.