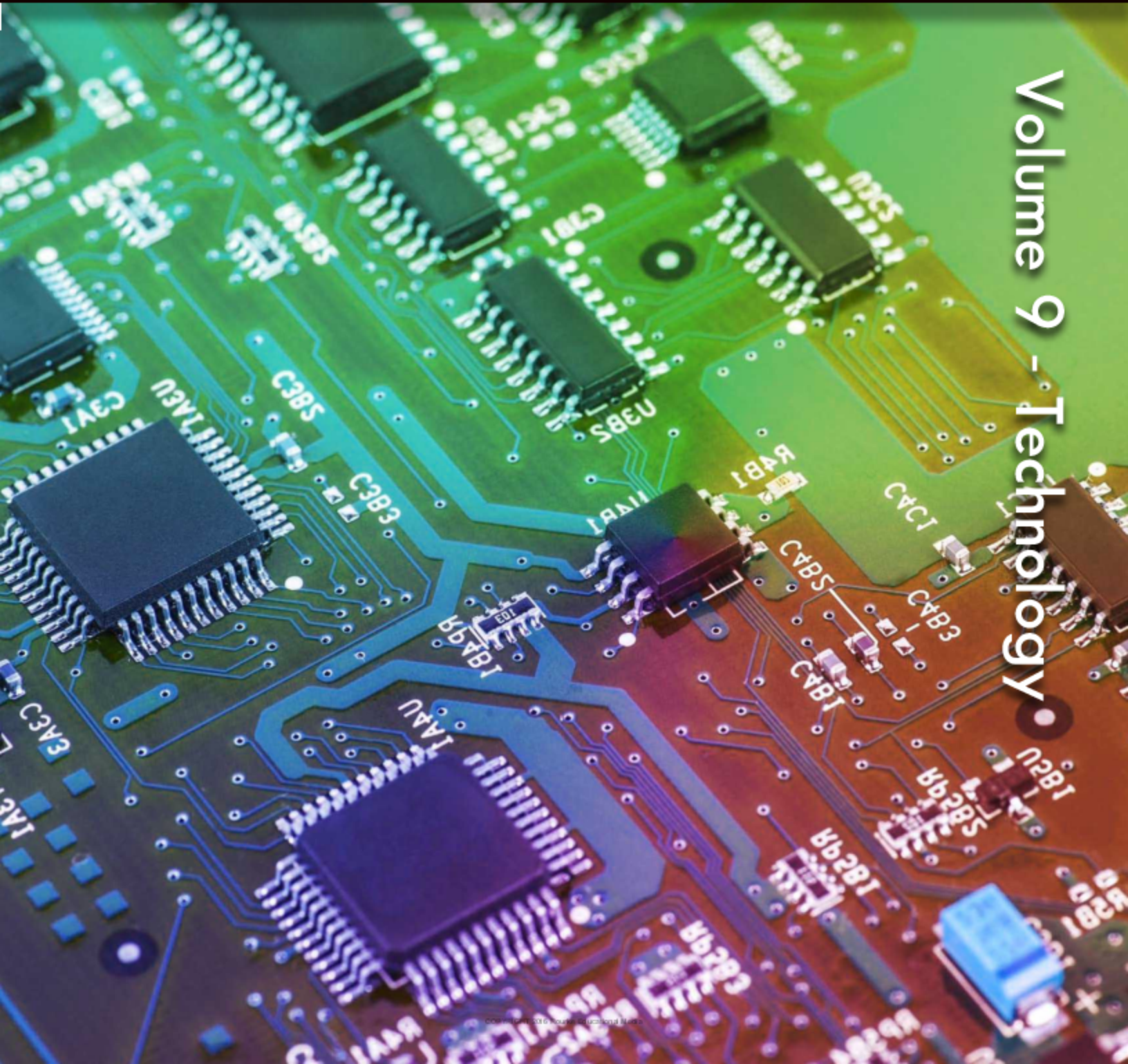




Rourke's World of Science ENCYCLOPEDIA

Volume 9 - Technology



Rourke's World of Science
ENCYCLOPEDIA

Volume 9

TECHNOLOGY

By Nancy Harris

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Debbie Ankiel

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What Is Technology?

Science is the search for knowledge. Scientists look at the world. They observe how things work and develop ideas about ways to make them work better. Sometimes they try to test an idea to explain how something works. Scientists perform experiments to find out how things work. The knowledge that they discover is useful for many things. It can help to build new machines. It can help scientists to develop new medicines or cure a disease. Technology is the use of scientific knowledge to create new things.



Scientists must often wear protective clothing.

Inventors

An inventor is a person who creates a new idea or device to perform a task. An invention is the new technology created. An inventor with a new idea or design for an invention may decide to have the idea protected. The idea gets protection from the law in a paper called a patent. A patent prevents other people from making, using, or selling the new idea without permission from the inventor. Some inventions are simply a better way of doing or building something. They may improve an existing technology. Other inventions are much more complicated.



In the 1800s, telephones had a crank to ring the operator for assistance to make a call.



Cell phones, a new invention in the 1950s, were used only for telephone calls.

Today's technology has been in the process of development for thousands of years. New inventions are constantly changing how people work and play. They change how people think and live. The future will bring even more changes. This will happen as we continue to learn about the world.

Agriculture

Thousands of years ago, humans relied on hunting, fishing, and gathering to provide food for their families. They looked to find edible plants for food. Soon people realized they could grow these plants. They also found they could make clothing out of plant fibers, or threads. People used cotton and flax to make clothing. This was the beginning of farming. People had to learn how to prepare, or cultivate the soil for planting crops. They learned how to breed, or grow plants. They learned how to process, or change plants to grow what they wanted. Agriculture is the science of growing crops. Agriculture has used advancements in technology to improve the methods for growing and harvesting crops.



Wheel rakes attach to tractors and sweep cut grain crops into piles. Often farmers use other equipment to make the piles into bails.



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Farm Equipment

A farmer plants crops in shallow trenches. Sowing the seeds is another way to describe the process of planting. Furrows are shallow trenches that look like narrow grooves in the ground. The farmer turns over the dirt to mix nutrients into the soil. Plants need nutrients to stay healthy. Farmers also turn the ground in order to loosen the soil and give seeds room to grow.

One invention designed to break up soil is the plow. A plow is a piece



Farmers plow in a straight line wherever possible.

of metal shaped liked a V in the front. It digs furrows when dragged along the ground. A farmer pushes the plow from behind or pulls it from the front. He may also use an animal like a horse or an ox to push or pull the plow. A tractor is used to pull many farming

machines. Tractors are a type of vehicle which has large wheels to keep it from sinking in mud.



A horse pulling a plow makes a single furrow.



A tractor pulling a plow makes many furrows.

Sickles and Reapers

Farmers need to harvest the crops, or cut them down and gather the useable portions after they have grown to full size. People can cut crops by hand. One invention they can use to make the job easier is a sickle. A sickle is a tool with a sharp, curved blade. Harvesting with a sickle is hard work and takes a long time. The reaper is another invention. This is a machine that cuts wheat and other grains using many blades. It works much faster than a sickle.



Another name for a sickle is a scythe.



Reapers (threshing machines) can cut a lot of grain in a short time.

Cotton Gin

Following the harvest, there is sometimes more work to do. Farmers must process some crops before they are used. For example, cotton grows in balls with many small seeds. The cotton fibers must be unwound and someone must remove all the seeds. People then make thread from the cotton. A worker will weave the thread into fabric for clothes.



A cotton boll holds the ripe balls of cotton.



Commercial looms weave lots of cloth at one time.



Eli Whitney (1765-1825)

Getting to know...

Eli Whitney was born in Westborough, Massachusetts, on December 8, 1765.

Whitney worked as a farm laborer and schoolteacher to save money to attend Yale University. In 1793, Eli Whitney learned of the problems with processing cotton and developed a machine that would use a comb and roller to make the work much easier. He invented the cotton gin. His invention made it easier and quicker to separate the cotton fibers from the seeds. Eli ran into many problems with his request for a patent, but it finally received approval by the court in 1807.

Chemicals

Fertilizers

Fertilizers are substances that add nutrients to the soil to help plants grow. Natural fertilizers have been used for centuries. They include manure, or the excrement of animals. They also include guano, which is made of bird and bat droppings.

Compost is a mixture of decaying plant material, and people use it as a fertilizer. Some farmers use chemical fertilizers to help their crops grow. Chemicals are things which may be found in nature or created in a laboratory.



Liquid fertilizer is sometimes added to the soil.

Find out more

Compost

Compost is one of nature's best mulches and is a great soil fertilizer. Did you know you can make your own compost? You can make it without spending any money and it will make your garden or the plants in your yard grow

Protecting Plants

Some farmers use poisons to protect their crops from weeds and insects. Herbicides are chemicals that destroy unwanted plants. Many people spray herbicides to kill weeds. Pesticides are chemicals that kill insects. An aphid is a type of insect that will eat the leaves of a farmer's crops. Other types of insects that can destroy plants are locusts and weevils. Farmers will spray pesticides to prevent these insects from destroying their crops.



Airplanes and helicopters are both used for crop dusting large areas with pesticides.

strong and healthy without the help of chemicals from the store. You can use yard cuttings, fruit rinds, vegetable peelings, and even tea bags to begin your compost. There are many conservation groups and websites that can help you to get started.

Organic Farming

Organic farming is a natural way of farming. It is the practice of raising plants, especially fruits and vegetables, without the use of synthetic pesticides. Many people believe using harsh chemicals on plants or produce can be harmful to the health of the humans who regularly use the foods which have been exposed to chemicals. Organic farmers use only things naturally occurring in nature, such as manure to help plants grow. Organic farming does not use chemical fertilizers, herbicides, or pesticides.



Organic vegetable gardens can produce delicious nutritious food.

Words to know



fertilizer (FUR-tul-ahy-zer): any substance used to increase the ability of the soil to promote plant growth

organic (or-GAN-ik): a substance, especially a fertilizer or pesticide, of animal or vegetable origin

synthetic (sin-THET-ik): something that is man-made



Rachel Carson (1907-1964)

Getting to know...

Rachel Carson was born in Pennsylvania in 1907. She always loved nature and writing. Carson studied biology, the science of life, in college. Then she studied marine zoology in graduate school. This is the study of sea animals. Carson wrote three popular books about the ocean and the creatures in it.

Carson then turned her attention to the land. A friend of hers noticed that many of the birds on her property died rather suddenly. This happened after the spraying of pesticides in the area. Carson studied the impact of the pesticide DDT. She found that the poison contaminated or dirtied the soil and water. It also killed birds. Carson wrote about what she discovered in 1962. She called her book *Silent Spring*. Her warnings made people think about the negative effect technology can have on the environment.

Transportation

People and things have always had the need to move or be moved from one place to another. People have always looked for more comfortable or quicker ways to travel. Transportation

is a way people and things move from one place to another. Different environments require different methods of transportation.

Timeline of Transportation After 1600



1662 - Blaise Pascal invented a horse-drawn public bus.



1783 - Joseph Montgolfier and Étienne Montgolfier launched the first hot air balloons.



1814 - George Stephenson built the first practical steam powered railroad locomotive.



1900 - Ferdinand von Zeppelin built the first successful airship.



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Engineers study traffic patterns, structures, materials, and techniques to help them design safe and efficient roads.

People have invented machines, called vehicles or crafts, to travel. Some vehicles travel on the ground, like a train. Some vehicles travel on top of the water, like a jet ski. Some even help people to travel under the water, like a submarine. People use other types of crafts to travel in the air. A hot air

balloon is an interesting way to travel through the sky.

Crafts such as rockets can help people to travel into space. Over the centuries, inventors designed machines or improved ways of traveling to move people faster and faster.



1903 - Orville Wright and Wilbur Wright flew the first motor-driven airplane.



1908 - Henry Ford developed the assembly line method of automobile manufacturing.



1926 - Robert Goddard launched the first liquid-fueled rocket.



1981 - John W. Young and Robert L. Crippen were the first astronauts to fly in a space shuttle mission.

Ships and Boats

One of the earliest ways to transport people and things was by traveling in the water. Boats are small crafts generally used for a special purpose like fishing. Ships are larger crafts that might use sails or an engine to propel them through the water. They may travel on rivers, lakes, or oceans.

Boats With Paddles

People use flat wooden boards called paddles to row small boats. An oar is another name for a paddle. A raft is a simple boat with a flat bottom. We can make a raft using tree trunks or logs. Sometimes, flat pieces of wood called planks are bound together to make a raft. Some rafts are made of rubber or a plastic called vinyl. These rafts are often inflatable.

A canoe is a small boat. It has curved sides and a pointed bottom. Early Native Americans made canoes out of tree trunks. They hollowed



Canoes were made and used for early transportation.



Large ships are able to move many people and things at the same time.

out the trunk and used a paddle to move from place to place. Today, an artificial substance, made by man, called fiberglass is a popular material for building a canoe.

A kayak is a sleeker version of a canoe with one or two small holes. The holes are where people sit. A rider may attach a watertight skin or enclosure to prevent water from getting in the boat. The boat can turn all the way over without sinking. Some people compete

Words to know

- inflatable** (in-FLEY-tuh-buhl): an object that can be filled with air
- planks** (plangkz): a piece of lumber that is cut thicker than a board
- vinyl** (VAYHN I): a type of plastic

in kayak races. The Olympics have had a kayak event since 1936.



Kayaks were originally used by hunters in subarctic regions.

Boats With Sails or Motors

Other boats and ships use different types of power. A sailboat uses pieces of canvas or other fabrics called sails. Wind fills the sails and pushes the boat forward.



Sailboats have the right-of-way over motorboats because the sailboats must rely on the wind to move them.

Ancient Egyptians used sailboats to move the stones for the Great Pyramids from Aswan to Giza. Pilgrims traveled from England on a large sailboat called the *Mayflower* to reach America in 1620.

A motorboat uses an electric motor and propellers. Propellers are turning metal blades that help the vessel to move through the water. A speedboat is a small, but very fast motorboat. Speedboats pull water skiers, help the Coast Guard or marine patrol on rescue missions, or might even compete in a race.



Motorboat drivers and passengers should learn and follow the rules of boating.



A steamboat driven by a large, single paddle wheel at the stern is called a stern-wheeler.

Larger Boats and Ships

Most large ships are made of metals like iron or steel. They use giant propellers powered by engines to move through the water. A steamboat is a large boat with paddles. A steam-powered engine turns the paddles to move the boat.

The biggest ships are tankers and aircraft carriers. Oil tankers can carry

millions of barrels of oil inside huge cargo areas. Designers built tankers to travel long distances and other than oil, they may transport water, chemicals, or liquefied natural gas.

Aircraft carriers are long, flat warships designed to act as a floating airbase. Planes take off and land on the runways on the top of the ship.



When an oil tanker collides with another ship or an iceberg, it may spill oil into the sea. This creates an oil slick (a film of oil floating on the water).



The Navy is the branch of the United States military whose pilots land on aircraft carriers.

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A submarine is a metal ship that can travel underwater. A submarine can be small enough to carry one or two people and remain underwater for a few hours. They can also be very large, have a crew of over eighty people and remain underwater for a few months.



When a submarine is docked in port, much of the ship remains underwater.



Robert Fulton (1765-1815)

Getting to know...

Robert Fulton was born in Pennsylvania in 1765. His father died when Fulton was only nine. Fulton worked as a portrait painter. He did not have much success. Then he decided to study engineering, using science to solve problems. He patented a method for building canals. Canals are man-made waterways.

Fulton moved to the country of France. At that time France was at war with the country of England. He designed a boat that could travel underwater. He thought its purpose could be to attach a mine or torpedo to enemy ships. In 1800, Fulton built the Nautilus, the first submarine. He also became famous for turning the steamboat into a commercial success. Although other inventors worked to develop steamships, his improvements allowed steamboats to carry more people and cargo. Carrying passengers and materials on rivers became much faster and safer.





When a freight train pulls a heavy load up hills, it may be pulled by several engines (locomotives) hooked together.

Trains

A train is a vehicle that runs on tracks, or rails. Passenger trains may have many compartments for people to travel from one place to another. Freight trains carry cargo, or things. Different cars transport different types of items. Refrigerator cars transport food. Container cars need a crane to lift cargo in or out of the car. Tanker cars transport different types of liquids.

Light Rail

People sometimes use the term light rail to talk about trains that run on city streets. A trolley, also called a streetcar, is one type of light rail transportation. Horses pulled the first streetcars. Modern streetcars usually get their power from electricity. Electricity makes things run.

A subway is a light rail system of cars. A subway runs on the street and in underground tunnels. Many large cities have a network of subway tunnels.



In cities, trolley cars are good transportation for short distances.



Subways are an efficient method of moving large numbers of people quickly in many of the large cities of the world.

Big Trains

Big trains have wheels that run on railroad tracks. They travel long distances between cities and towns. The first car on a train is the locomotive. The locomotive powers the train. The first trains used steam engines. Today, most trains get power from using gasoline or electricity.

High-speed rail trains are electric trains that run faster than a regular train, sometimes called a bullet train. These high speed rail systems also transport people in Germany, Korea, and Spain. The first countries to build and use the bullet train are the countries of France and Japan.

The monorail is another type of train. Most monorail systems run on a single rail. Some monorails are suspended. The train cars actually hang from the track.



Bullet trains move quietly and quickly.



The word monorail means one rail.



Granville T. Woods (1856-1910)

Getting to know...

Granville T. Woods was an African-American inventor. He was born in Ohio in 1856. He left school when he was ten years old so he could work. Woods continued his education at night school. He had many jobs. He worked in a machine shop and on the railroad. He worked in a factory and on a steamship, then he started his own electronics business.

Woods became a successful inventor. He invented a telegraph system. It let trains and railroad stations send warnings and other messages. He also developed trolley cars. They ran using overhead power lines. Woods invented the telegraphony. This is a combination of a telegraph and a telephone. The operator could send messages verbally or by Morse code.



A telegraphony helped during wartime to send secret messages or encrypted verbal messages.

Motor Vehicles

People drive and are passengers in motor vehicles in most places of the world. Motor vehicles have wheels and a motor. They can be driven on many different land surfaces. Cars, buses, and trucks allow people and things to travel to certain places. They can travel where boats and trains cannot go.

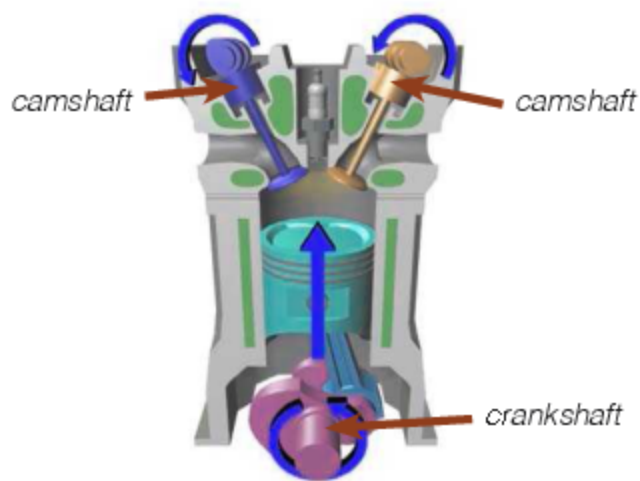


A sedan is a four door car making it more convenient for families or people carrying more than two passengers.

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Cars

Cars are vehicles used by people to get from one place to another. Combustion engines are often the power source for cars. This type of engine burns gasoline or diesel fuel to run. Some people are concerned that combustion engines are contributing to pollution in the air.



A four-stroke engine

Inventors are developing other types of power systems to make cars run. Electric cars have electric motors that run on batteries. Some cars use hydrogen to provide power. A hybrid car uses a combustion engine and



Hybrids look like standard automobiles.

battery power to make the car work.

Cars come in a variety of sizes. A limousine is a long car. It has space for many passengers and has a chauffeur to drive the vehicle. A microcar, also called a bubble car, is very popular in countries outside of the United States. Auto makers designed the microcar to use less gas. It is also economical because a small amount of material is necessary to build the car.



Limousines are often referred to as limos.

Words to know

- chauffeur** (SHOH-fur): a person employed to drive a private automobile or limousine for the owner
- combustion** (kuhm-BUHS-chuhn): burning, the process of combining fuel with oxygen to produce heat
- gasoline** (GAS-uh-leen): a flammable liquid mixture of hydrocarbons obtained from petroleum, which is used as a fuel for combustion engines

Some people like to drive a sports car. It can go fast. The fastest cars are race cars. Some cars have special features. A convertible is a car with a fabric top that folds back. Instead of fabric, some convertibles have a hard top that the owner can remove.



Buses

Buses are bigger than cars. A bus has a long body with several rows of seats or benches for passengers. Buses usually operate on a schedule. A school bus carries children to and from school. A passenger bus can carry people long distances. They travel between different cities and towns. A tour bus carries tourists or people on vacation. Some people charter, or rent, a bus for special purposes.



The stop sign which a school bus driver activates is a warning to drivers to stop for school children.

Trucks

Vehicle engineers designed trucks to carry materials of all kinds. Pickup trucks are a bit bigger than cars. They have a flat bed behind the passenger compartment. They can carry many things in the flat bed. Large trucks transport different kinds of heavier materials or equipment. They carry things to places where trains and boats cannot travel. An 18-wheeler is a very big truck. It has 18 separate wheels.



Sometimes, pickup trucks are used as emergency vehicles.



It is wise to leave extreme space between your car and an 18-wheeler so the truck driver can see your car in his rear-view mirrors.

Aircraft

Hot Air Balloons, Blimps and Dirigibles

Aircraft are vehicles or machines that let people travel through the air. The first type of air transportation was the hot air balloon. It is the oldest

successful human carrying technology for flight. It floats using a large bag of silk or nylon filled with heated air. People travel in a wicker basket called a gondola, that hangs underneath.

A blimp or dirigible is like a balloon. The gas helium fills up the balloon to help it float. It has a motor to push it forward. This type of craft was very popular before 1940.



The first hot air balloon flight carrying humans was on November 21, 1783 in Paris, France.



Advertising blimps are sometimes equipped with television cameras when flying over an athletic field.

As technology for airplanes improved, people stopped using blimps to travel. Today, advertisers use blimps to market their products. Some companies offer sightseeing tours in a blimp.

Airplanes, Gliders, Helicopters

An airplane is an aircraft that flies using wings and an engine. The Wright brothers receive credit for the invention of the first airplane in 1903. Airplanes can be small and carry only one or two people. Commercial airplanes can be large and carry many passengers a long distance in a short amount of time. Most airplanes take



Some jet airplanes are so huge that helicopters or cars can be carried inside them.

off on a long road called a runway. Air lifts the airplane up. This happens as the air passes over and under the wings. A small airplane gets its power from propellers. Propellers are on the

outside. A motor makes the propellers turn. Most larger airplanes have jet engines. This type of engine has many turning blades inside. They move air much faster than ordinary propellers.

Jet airplanes use turbines to make them move faster. The military uses supersonic aircraft, such as fighters or bombers, to move quickly with a great amount of power. A fighter jet is a small military airplane that can go very fast.



Military airplanes are often painted muted colors while commercial airlines use brighter colors to advertise the name of the airline.

The Concorde is one of the only supersonic planes used as a commercial airplane. It carried passengers from Europe to America in less than half the time it took for a regular airplane to fly the same distance. The Concorde was very expensive to fly. Due to rising costs, the Concorde was retired from

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use. The last Concorde flight was on October 24, 2003.



You are not likely to see a Concorde in flight anywhere.

A glider has a similar shape to an airplane. It uses only the wind for power. The military may use gliders to deliver troops. Gliders are very quiet because they don't have an engine. Some people participate in glider competitions.



Glider have no propellers or jet engines.

PROJECTS



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A helicopter is an aircraft with a large propeller on top. It can rise into the air, or take off, straight up. A helicopter can take off without using a runway.



Helicopters may land on a hospital roof helipad with emergency patients.



Military helicopters can deliver personnel and supplies to places where there are no runways.

Words to know



commercial (kuh-MUR-shuhl): transporting passengers or cargo for profit

supersonic (soo-per-SON-ik): traveling through air faster than the speed of sound



turbines (TUR-bine): a machine that uses steam, water, or gas to create energy and is often used in jet engines

Rockets

A rocket is a vehicle that travels into the air at a very high speed. It burns fuel to make thrust. Thrust pushes, or propels, the rocket upward. A rocket engine ejects the thrust out of the bottom of the rocket. A lot of energy is required to propel a rocket into space. Energy is necessary to make things happen. Astronauts and cosmonauts are people who travel into space using rockets. Rockets also lift satellites into orbit. Satellites study the Earth and other objects in the universe.



People must be far away from the base of a rocket at the time of blastoff.

Rocket Design and Travel

Multiple sections or stages make up the design of most rockets. Each stage contains its own fuel supply and rocket engine.

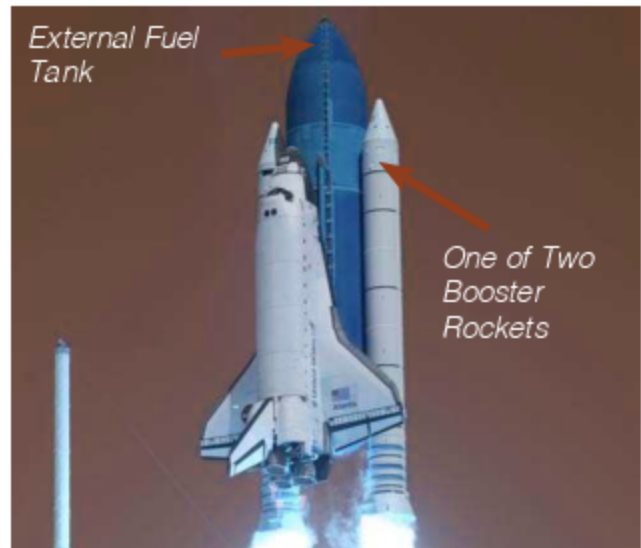
When its fuel is used up, a rocket is released. This lightens the weight of the rocket. It allows it to travel faster. A rocket needs to travel at least 17,700 miles per hour, (28,500 kph) to make it out of the atmosphere into space. This speed is the escape velocity. The part of the rocket that actually reaches space is often called a spacecraft.



Stage 4 of a rocket is called the payload.

rockets

Some rockets get extra thrust from booster rockets. The scientists usually attach the boosters to the side of the main rocket. The space shuttle was an example of both a rocket and an airplane. It takes off like a rocket. It releases two booster rockets. As the rocket uses up its fuel, it will also release an external fuel tank. The space shuttle lands like an airplane when it returns to Earth.



A space shuttle is also called a spaceship.

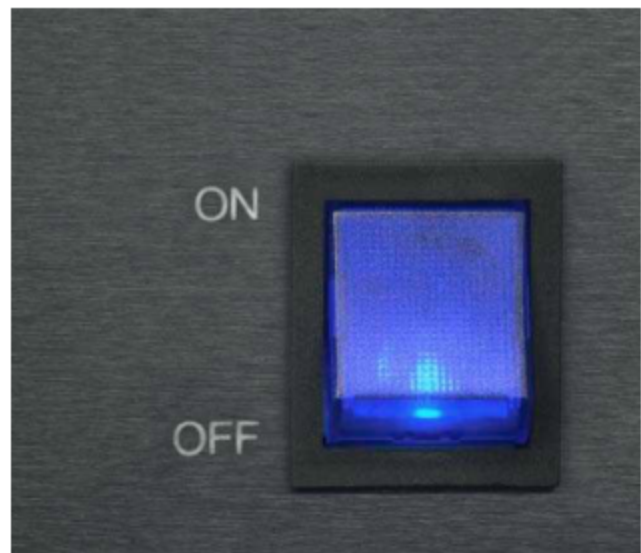
Electronics

Currents

Much of modern technology is the development of a variety of tiny electronic devices. Electronics is the study of devices used to control electric current. A current is moving electricity, usually conducted, or moved, in a wire. Different things can happen to currents. Some electronic parts switch the current on and off. Other components make the current larger or smaller.

Types of Currents

There are two different types of electronic current. Direct current,

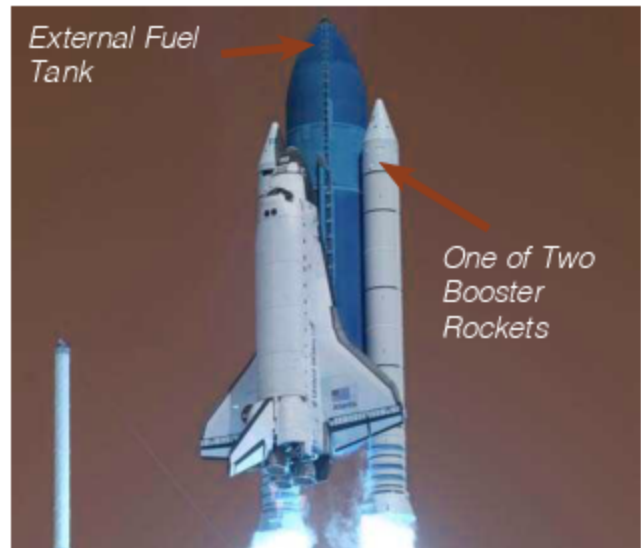


A toggle switch is used to turn the current on and off.

or DC, flows down a wire in only one direction. It remains constant. Direct currents make computers and electronic clocks work properly.

rockets

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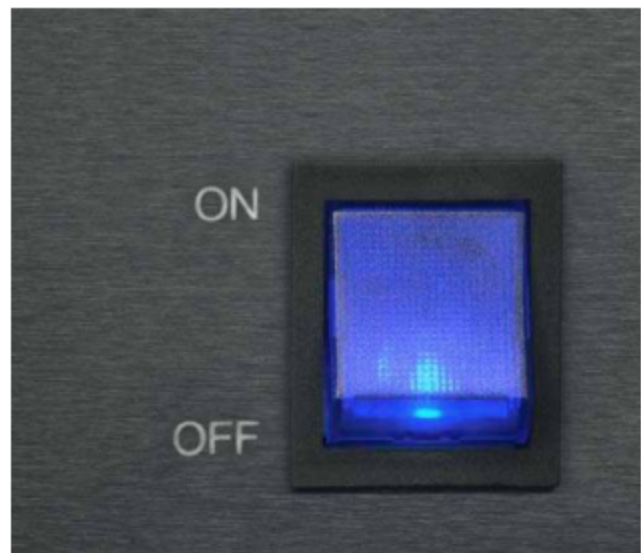
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Types of Currents

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or DC, flows down a wire in only one direction. It remains constant. Direct currents make computers and electronic clocks work properly.



When your computer is plugged into the AC outlet, a built-in power adapter charges the AC to DC.

Alternating current, or AC, moves first in one direction and then in the opposite direction. AC is the type of current that delivers electricity to homes and businesses. Frequency is how many times the current changes direction each second.



Sound systems and TVs operate on alternating current.

Electronic devices are things that use electricity to work. Computers, televisions, radios and video games use electricity. Can you think of other things that use electricity?

Circuits

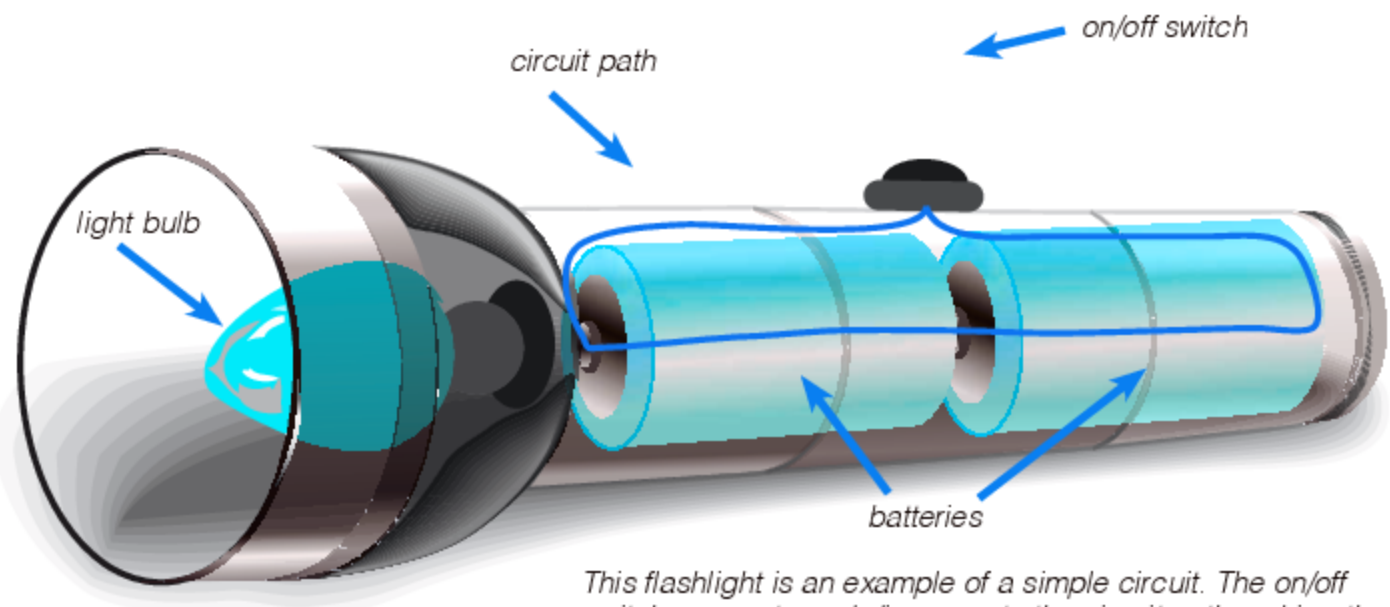
Electronic Circuit Components

A circuit is a group of electronic components or parts. Electronic circuits are made of parts that are connected. There are several types of electronic parts. Batteries store chemical energy. This can be converted or changed into electrical energy. Resistors control the current. Transistors make the current stronger, or amplify it. Capacitors store energy.



Batteries have a positive (+) end and a negative (-) end.

Devices like motors and light bulbs convert, or change, energy. Electronic circuits use these components in different combinations to perform different tasks. Circuits come in many



This flashlight is an example of a simple circuit. The on/off switch connects and disconnects the circuit path making the light bulb turn on and off.

sizes. Some are big. Others are tiny. These components form a complete path for the electric current. The current starts and ends in the same place. A very simple circuit forms a complete loop like a rubber band.

of the chemical energy from the battery is converted. It changes into light energy.

Simple Circuits

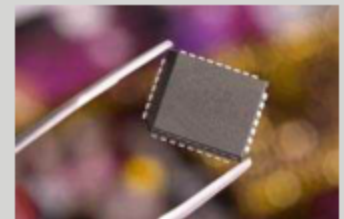
Electronic circuits can be as simple as turning on a light bulb. The components of a flashlight are a battery, a switch, wires, and a light bulb. When the switch turns “on” the circuit completes its path. Electricity can flow. It flows from the battery, through the light bulb, and back to the other end of the battery. The filament, or wire, inside the light bulb heats up. The filament becomes so hot that it emits, or gives off, light. In this circuit, some

Find out more

A Circuit Can Fit on a Tiny Chip

Sometimes, complicated circuits can be a few millimeters, or a fraction of an inch long! They are integrated circuits. These circuits are found on microchips.

Microchips allow some electronic devices to be very small. Cell phones have microchips.





Nikola Tesla (1856-1943)

Getting to know...

Nikola Tesla was born in Croatia in 1856. His father was a clergyman and his mother was an inventor. His mother had a great influence on his life. Tesla loved solving problems in science and mathematics. He came to the United States in 1884. He became Thomas Edison's assistant. He disagreed with Edison about the best form of electric current.

Tesla developed a form of electricity called alternating current, or AC. He designed electronic components. They allowed power to travel over long distances. He also discovered medical uses for electricity. Tesla invented other electronic devices and developed the basic principles for many more. Many of his inventions were not valued during his life. Only after his death did Tesla get the praise he deserved.

Complex Circuits

Many circuits are complex as we see in a powerful computer. Computers use many combinations of different types of components. These components often combine together on a circuit board. Some of the components used in computers include processor chips, RAM, and ROM.

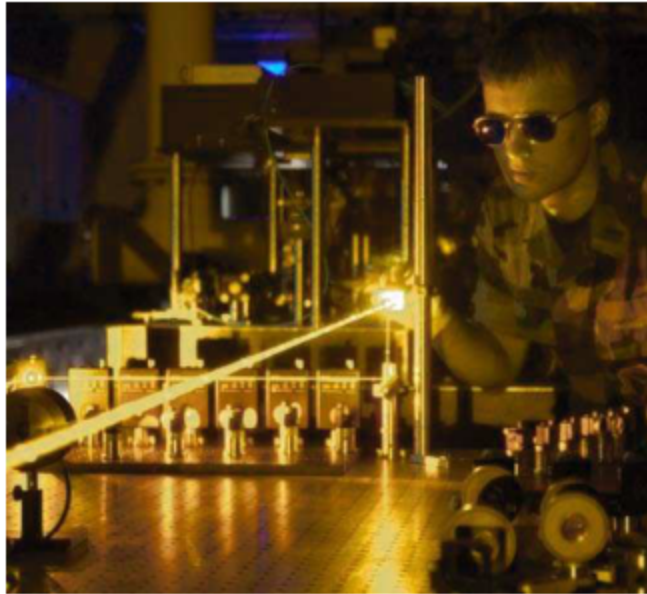


Lasers

Lasers are devices that make an intense, narrow, and single-colored beam of light. The word "laser" stands for "light amplification by the stimulated emission of radiation." Scientists introduced the first laser in

1960. Many lasers consist of a tube that contains gas. Scientists use different types of gases to make different colors of light. The light happens when the gases become active or energized. The gases usually gain energy when combined with electricity. Helium-neon lasers create a red light. Argon

lasers can produce blue and green light. Helium, neon and argon are gases. Lasers range in size from microscopic to the size of a football field.



Laser beams shine in a straight line.

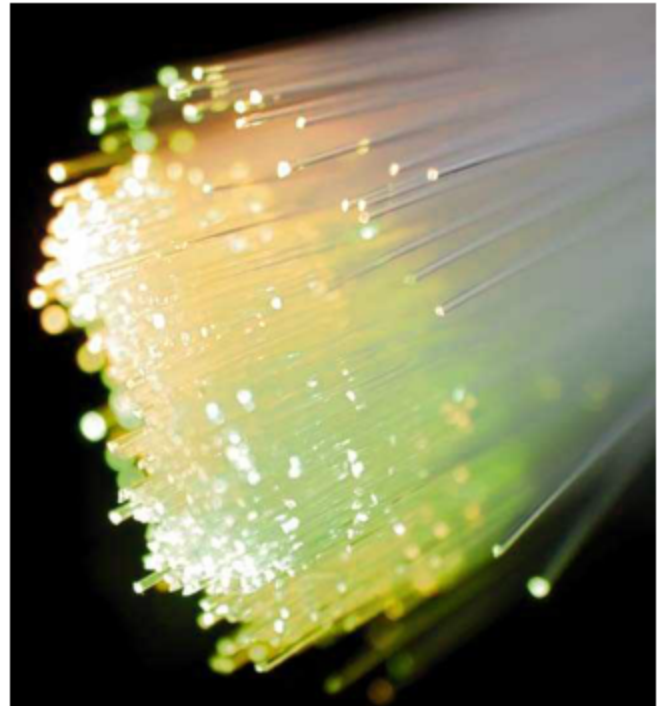
Seeing Lasers

You cannot see some lasers unless they reflect off of a surface. Other lasers are easier to see. High-powered lasers cause particles in the air to light up. Usually, a laser beam is visible when it passes through dust or smoke.

Using Lasers

There are a lot of different uses for lasers. Some people use a laser as a pointer. They shine a little dot on a wall far away. This is especially helpful to teachers. Some people use other kinds of lasers to transmit or send

computer information very quickly. They do this through fiber optic cables. They are very thin groups of glass or plastic.



Fiber optic cables carry computer information sent with lasers.

Laser printers and compact disc players are common products that use lasers. A bar code scanner in the grocery store uses a laser to read the code. Doctors use medical lasers in surgery. Surgeons use laser technology to remove unwanted tissue in the body. A doctor can make a precise incision using a laser.



For example, lasers are common for eye specialists to perform eye surgeries. Industrial lasers cut steel and other materials. Engineers often use lasers to measure distances or to mark a straight line.

Lasers enable doctors to perform some surgeries without making any incisions.

Holograms

Find out more 

Seeing Holograms without lasers

A hologram is a three-dimensional image. Sometimes, you can see a hologram without a laser. You can see these three-dimensional images with natural light. You can see holograms on most credit cards. Credit card companies use holograms to prevent people from making copies of the card. The hologram appears to move and change colors as you move the card.



Holograms are used on many banknotes.

Seeing Holograms with Lasers

People use lasers to make holograms. A laser beam splits into two separate beams. One of the beams reflects off an object onto a photographic surface, or plate. The other beam shines directly onto the photographic plate. It does not reflect off the object. This is the reference beam. The two beams combine to make light and dark areas on the photographic plate. Scientists call them interference patterns. These patterns make a three-dimensional image when lit with the same type of laser light.

There are many other types of holograms. Medical professionals use holograms. One day, computers may use holographic memory.

Medicine

Medicine is the science of keeping the human body healthy. It includes treating people when they get sick. Doctors need technology to help them with a diagnosis, or finding out what is wrong with a person. They need technology to create medications to help sick people feel better. They need technology to perform operations. Operations can help doctors to cure or treat a disease within the body.



Medical professionals can tell much about us by examining samples of our body fluids.

Microscopes

A microscope is a device used to make something look bigger. Scientists use microscopes in medicine to study cells for signs of disease. Cells are the building blocks of life. A specimen is the sample of cells that a

researcher will study. The specimen is generally too small for the eye to see without assistance from some type of technology. A scientist might stain, or color, the specimen to make its parts easier to identify.



A microscope is many times more powerful than a magnifying glass.



Compound Light Microscope

The most common type of microscope is the compound light microscope. When you use this microscope, a scientist presses the specimen between two glass slides. A scientist then places it on an area called the platform. A bright light shines below the platform. The image of the specimen is magnified by several glass lenses.

Electron Microscope

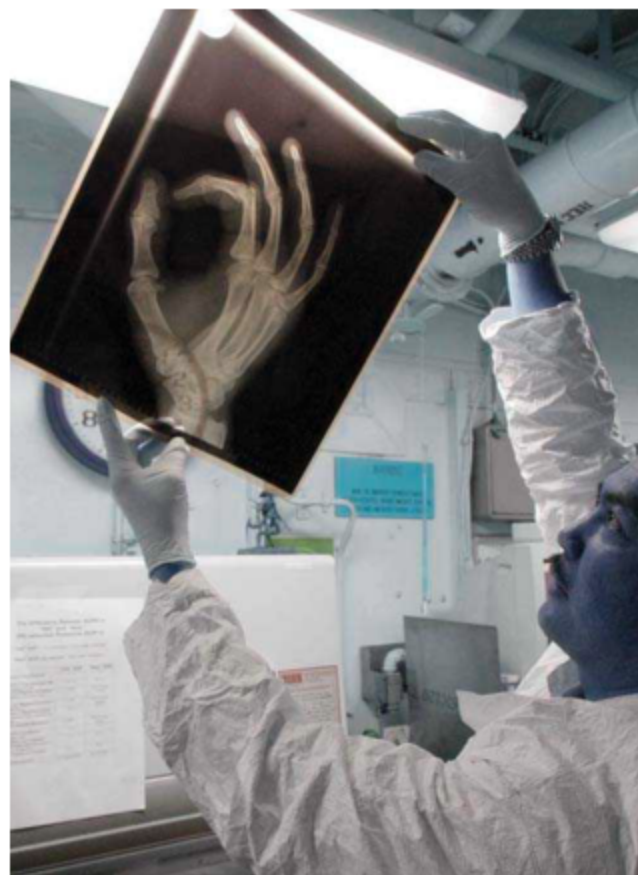
An electron microscope can magnify very small things. Instead of using waves of light, it uses waves of electrons. An electron is a small particle. You cannot see electrons with just your eye. The waves of electrons light up a specimen. Electron microscopes can show viruses and other things that are invisible to the eye. They can also show things that are invisible to light microscopes.



Electron microscopes are much larger and stronger than light microscopes.

Imaging

Doctors often need to know what the body looks like on the inside. Imaging is a way to take pictures of bones and organs, such as the heart. A simple imaging technology is the X-ray. X-rays are a type of radiation. Exposure to the rays in large amounts can damage tissues. Doctors use small amounts for diagnosis. An X-ray is like a photograph. X-rays allow doctors to see cavities in teeth. They allow them to see fractures in bones, or fluid in the lungs.



By comparing x-rays taken at different times, a doctor can tell how a body is changing.

Fluoroscopy

Fluoroscopy uses X-rays to show movement inside the body. It also uses a television type screen. It can show what happens when you swallow or when your heart beats. Surgeons use fluoroscopy during surgery if they need to have a consistent picture of what is happening in the body while the patient is on the operating table.



A fluoroscope helps a surgeon know what is happening inside your body.

Other Types of Imaging

Computed tomography scanning, or a CAT scan, creates millions of pictures. A computer puts these pictures together to make one image.

Magnetic resonance imaging, or MRI, uses magnetic fields. A powerful

magnet produces small pulses of energy. A computer uses these pulses to create a picture. Doctors use MRI to see soft tissues like the brain.



During medical tests using an imaging machine, you must lay very still.

Ultrasound imaging produces images with sound waves. It can show the movement of blood in an unborn baby.



Your first official photograph might be via ultrasound before you are born.

Surgery

Many doctors recommend surgery to treat or cure a disease or other problem inside the body. Surgery usually involves cutting into the skin and other tissues. For hundreds of years, a sharp knife called a scalpel was the tool doctors used. Today, advances in technology have created other ways to operate.



Surgery is performed in a cool, sterile room with very bright lights.

Words to know

- **abdomen** (AB-duh-men): the part of the body containing the stomach and intestines
- incision** (in-SIZH-uhn): the act of cutting into the body for surgical purposes
- surgical instruments** (SUR-ji-kuhl IN-stre-ment): tools used for scientific or medical purposes
-

Using An Endoscope

An endoscope is a fiber-optic tube inserted into the body. Fiber – optics are very thin groups of glass or plastic fibers. The fiber-optics send pictures to a screen so that the doctor can see what is happening inside the patient's body. Doctors see inside organs, such as the heart, and even what is happening inside blood vessels. Blood vessels carry blood around the body.

Laparoscopy is the use of an endoscope in the abdomen. The doctor attaches surgical instruments to the tube to perform the operation. This means that the incision into the skin can be much smaller.

Microsurgery

Surgeons often make incisions using lasers. In microsurgery, the surgeon uses a microscope and tiny instruments to repair tissue and cut away diseased tissue. Doctors use microsurgery to reattach a severed (cutoff) body part. For example, doctors will sew arms, legs, toes and fingers back on during microsurgery.

Communications

Humans communicate with each other in many different ways. The simplest forms of communication involve talking out loud, using hand signs, and writing down messages. Technology is used to increase the number of ways people can communicate. People have invented devices and systems that allow individuals to talk to each other when they are not together. Communications technology is an important part of both today's and tomorrow's society.

Telegraphs

People often need to communicate with each other over very long distances. One way people do this is to send electrical signals along a wire. The telegraph was one of the first devices that could do this. Telegraphs are relatively simple devices. Pushing down on a telegraph lever causes electric current to flow. This current travels very fast through a wire. At the other end of the wire is a telegraph receiver. Each pulse of current causes a special magnet, an electromagnet, to turn on. A clicker makes dots and dashes on a strip of paper when this magnet is

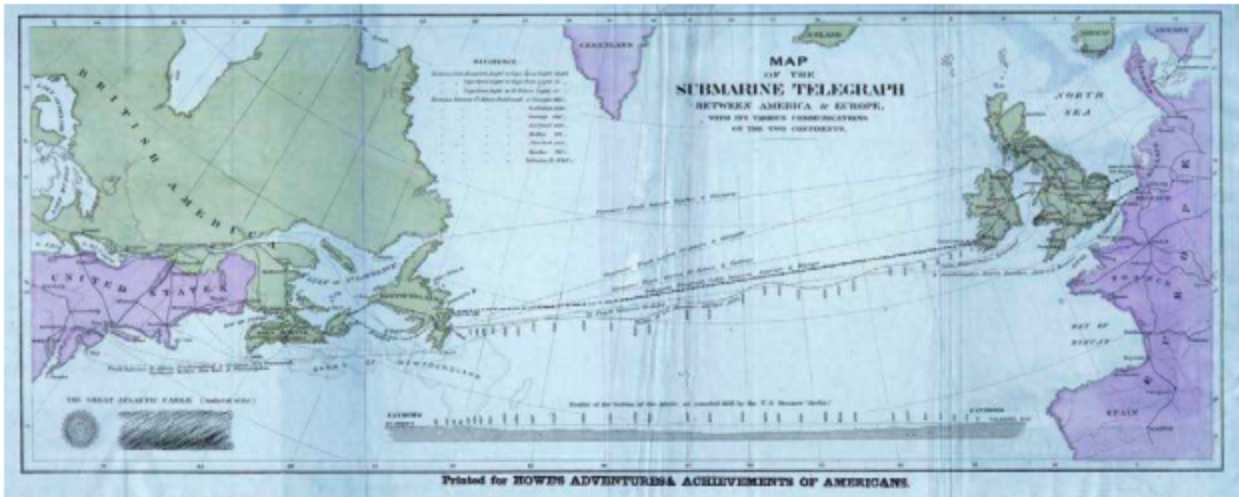
on. People sometimes call this strip of paper a ticker tape.

Workers laid very long telegraph cables all the way across North America. This transcontinental telegraph allowed people to



There was a charge for each word used in a telegram message.

communicate from New York to San Francisco. They were able to send messages across the country. Workers laid a metal cable across the floor of the Atlantic Ocean from the state of New York to the country of England. It went to the city of London. This was the transatlantic telegraph.



This old map shows the transatlantic telegraph line placement.

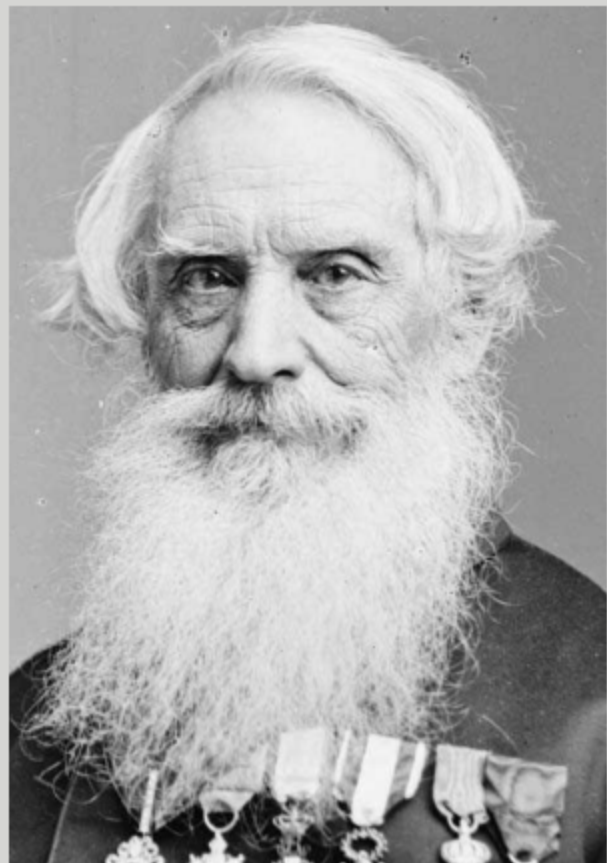
There are also wireless telegraph systems. A wireless telegraph system

allows people to send signals through the air.

Samuel F. B. Morse (1791-1872)

Morse Code

Sending messages over a telegraph line is not like talking on a telephone. You can make only long or short sounds, not words. A special code is needed that will be understood by the person sending and receiving the message. Samuel F. B. Morse created a list of sound patterns for letters and numbers. The name of this code is Morse code. A short tap on the telegraph makes a short sound called a dot. A longer tap makes a longer sound called a dash. People send a word or words using the dot-and-dash patterns for each letter, with short pauses between letters and longer pauses between words.



Telephones

People use telephones every day to talk with each other. A telephone is a device that converts or changes sound into an electrical signal. Another telephone far away can hear this signal. Telephones come in many shapes and sizes. The microphone is the part of the phone that people talk into. The microphone converts sound into electrical signals. It makes the sound louder. The receiver is the part of the

phone that allows people to listen. The receiver converts electrical signals back into sound.



Telephones make it easy to keep in touch with people.

Morse code was once very important when ships used the telegraph for communication. The universal or worldwide signal for a ship in trouble is SOS. This stands for "Save our ship." In Morse code, SOS is ... — People can also use flashes of light to send messages in Morse code. Many people in the military still learn Morse code.



Morse code

| | | | |
|---|---------|---|-----------|
| A | · — | S | ··· |
| B | ···· | T | — |
| C | —··· | U | ··— |
| D | —·· | V | ···— |
| E | · | W | —·· |
| F | ···· | X | —··· |
| G | —·· | Y | —··— |
| H | ···· | Z | —··· |
| I | ·· | 0 | — — — — |
| J | · — — — | 1 | · — — — — |
| K | — · — | 2 | ·· — — — |
| L | · — · — | 3 | ··· — — |
| M | — — | 4 | ···· — |
| N | — · | 5 | ····· |
| O | — — — | 6 | — ···· |
| P | · — · — | 7 | — ···· |
| Q | — · — · | 8 | — ···· |
| R | · — · | 9 | — ···· |

Types of Phones

There are several ways you can make a telephone call. A rotary telephone has a wheel, or dial, with numbers on it. The rotary phone makes a different pulse, or clicking sound, for each number dialed. A touch-tone telephone has a keypad with numbers on it. Touch-tone phones send out different combinations of tones, or noises, for each number that is pressed.

How Telephones Work

Telephone companies normally connect telephones to each other by a series of devices such as fiber-optic cables and copper wires. All these devices make up a telephone network. The network allows you to make a phone call to any other telephone line. Every phone line has a different telephone number.



Telephone companies are responsible for the telephone network. Individuals are responsible for the lines and equipment in their homes.



Rotary phones are no longer used but had to be plugged into a wall jack in order to operate.

People often have one telephone number in their home. The same line can connect several telephones to the same line. They will share the same telephone number.

Cordless Telephones

Many people have cordless telephones in their homes. They use radio waves to communicate with a base. The base connects to a phone line.



Cordless phones allow people to move around the house while talking.

People may hook up a telephone answering machine to their telephone line. The answering machine will make a recording of a phone call if nobody answers the phone.

Cellular Telephones

Some people carry cellular telephones with them wherever they go. Cellular phones are little telephones. They have powerful transmitters in them. They connect to other phones through a system of antennas called the cellular network. Cellular phones work as long as they are close to a cellular antenna. People

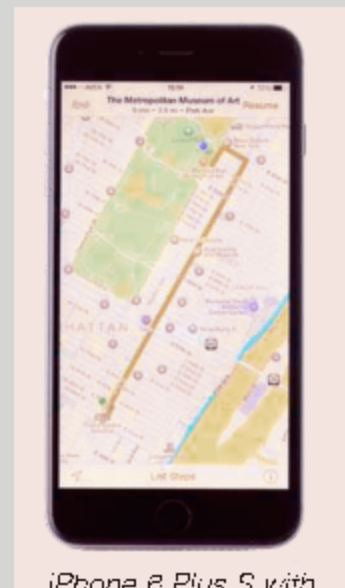
have to recharge cellular phones when the battery gets low.



Cell phones can be used almost anywhere now. In some countries there are more cell phones than people.

Find out more

New-generation cell phones combine many devices into one. When traveling, one of the most convenient of these features is the built-in GPS. When visiting a place that you aren't familiar with, getting lost is a lot harder when you have turn-by-turn directions on your cell phone. Even the cell phones that don't have GPS can use cell tower position and distance to calculate your location. Cell phones function by communicating with towers connected to a base station in a configuration called a "cell." As you move through the cell, the base station monitors your cell phone's signal and transfers it to the nearest tower. If your cell phone does not come with a built-in GPS, you can always buy an app to add one!

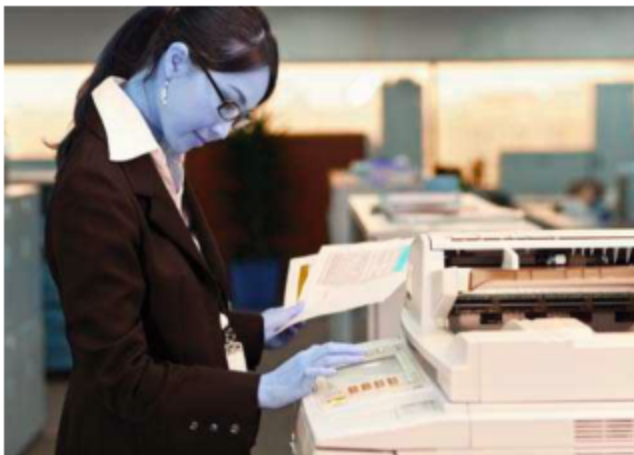


iPhone 6 Plus S with built in GPS

Copiers and Fax Machines

Photocopiers

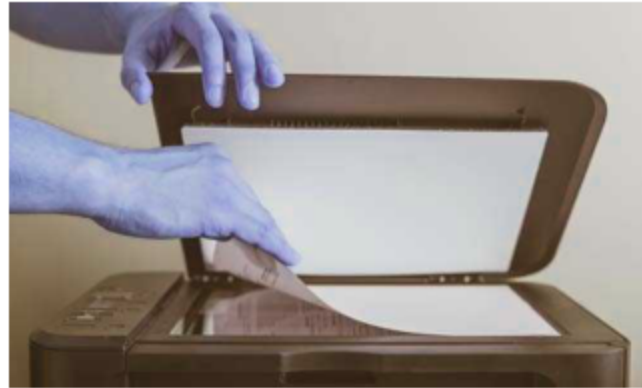
Photocopiers are devices that can make a duplicate, or copy, of an image. There are many different types of copiers. Traditional photocopiers use a black powder called toner. The machine uses toner to make a copy of the original image. The toner transfers from an image roller onto paper that is electrically charged. The machine then melts the toner into places by hot fuser rollers. The toner should not rub off when it comes out of the copier.



Modern day copiers also allow you to print in a variety of different colors.

Scanner

Other types of copiers use different methods for copying an image. A device called a scanner is often used. A scanner converts an image into computer data. The computer is able to store or print out the information.



Scanners can be small desktop devices or large freestanding machines.

Facsimile (fax) Machines

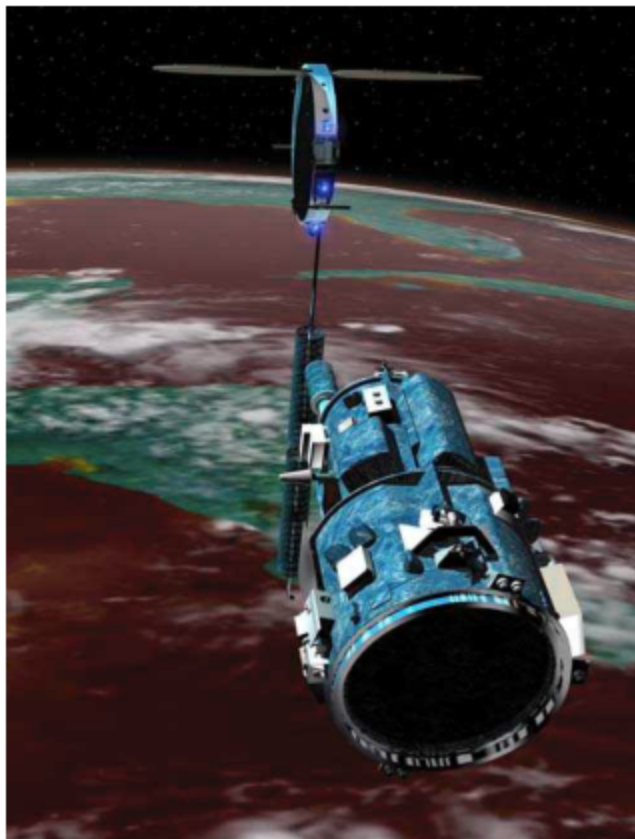
Facsimile or fax machines are copier-like devices. They send written and printed material to another fax machine using telephone lines. They often have a built-in scanner. It changes the image into data that transmits over a phone line. A fax machine receiving a call from another fax machine changes the data back into a printed image. Many people use the term fax to describe the image sent by a fax machine. Sometimes, people use computers to send faxes. They can send and receive a fax without using a single sheet of paper. Today, all these machines can be combined into one unit to make productivity much quicker and less expensive than owning three separate units.



Since the 1980s, fax machines have been an essential tool for most businesses.

Satellites

Communications on Earth often depend on technological devices in space. Satellites are anything that orbit around a planet. The moon is Earth's only natural satellite. Humans have sent up hundreds of man-made satellites. They orbit around the planet Earth.



The three main types of satellite orbits are polar, sun synchronous, and geostationary.

Communications Satellites

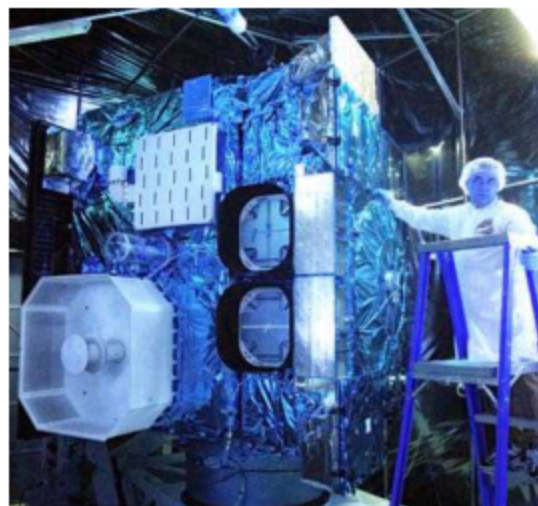
Some companies use satellites for telephone communication. They allow people to place phone calls instantly to any telephone on the planet. Communications satellites have other

uses. They can receive and transmit radio and television signals, allowing people to watch and listen to events as they happen around the world.

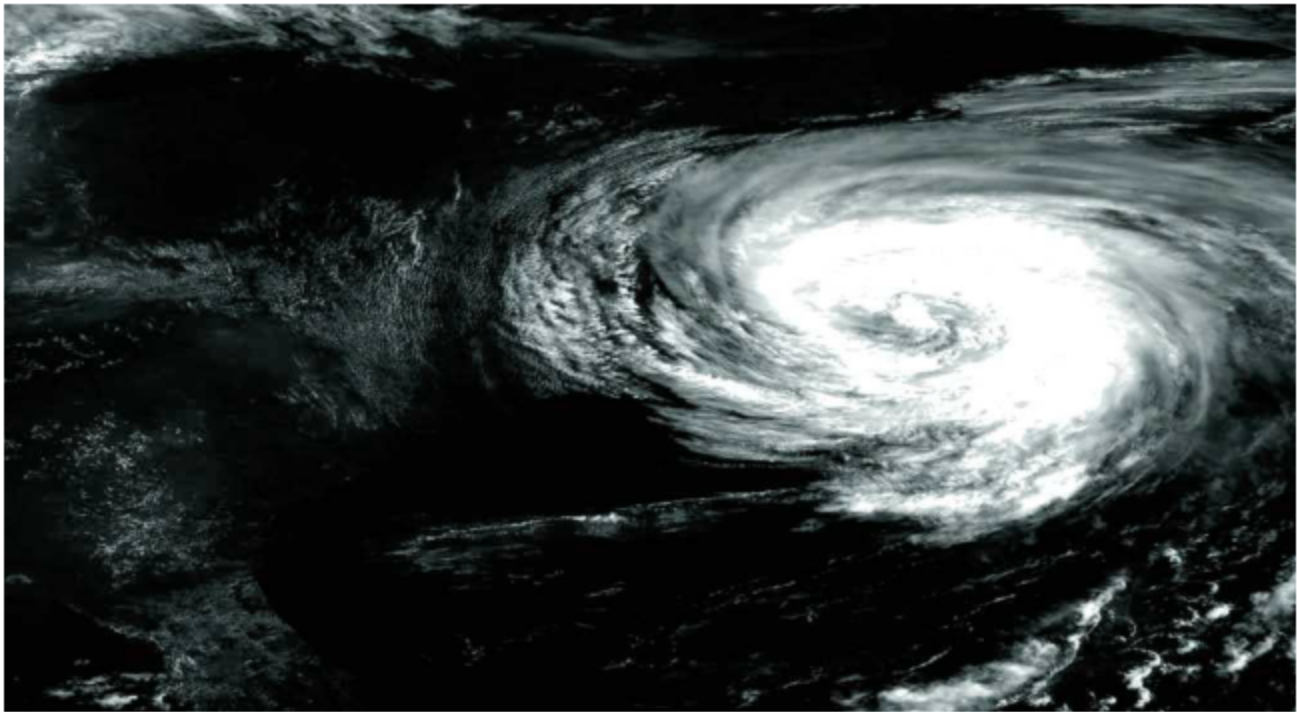
Communications satellites often have a geostationary orbit. This means that they stay over the same spot above Earth as it spins. Some people and companies have satellite dish antennas. These antennas allow them to receive satellite signals.

Weather Satellites

Scientists use other satellites to study the Earth. Weather satellites send images of clouds and storms covering the planet. These satellites often move about the Earth in a polar orbit. This type of orbit allows them to view the entire planet as it spins.



Most weather satellites have a lifetime of about seven years.

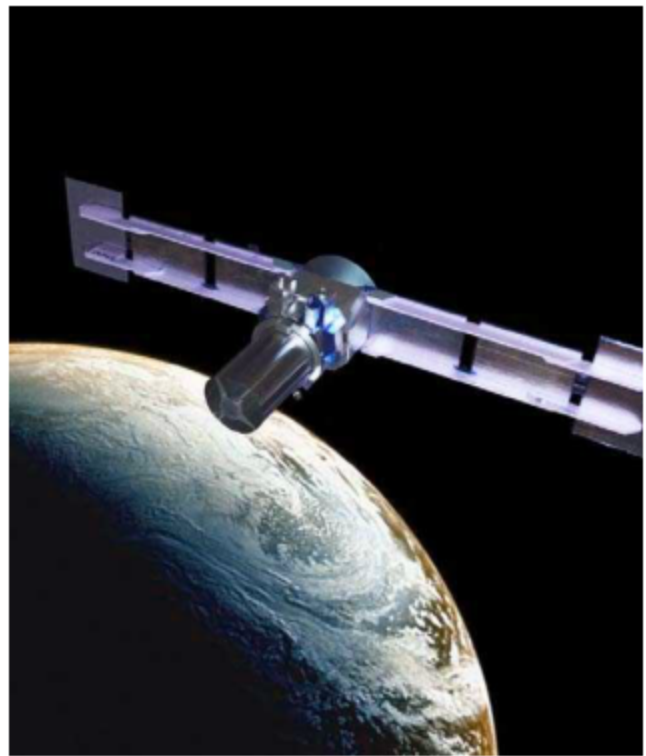


An image from the GOES-9 weather satellite shows a satellite image of a hurricane.

The weather is predicted using images from weather satellites. Often you will see satellite images on the weather and news channels on television.

Military satellites

The military sometimes uses satellites to spy on other countries. The satellites carry powerful telescopes. Telescopes are devices that magnify distant objects which people can not see with just their eyes. These telescopes can take detailed images of the Earth's surface. Other satellites with telescopes study the planets and stars.



The Earth looks like a big ball when seen from space.

Find out more 

Radar and Sonar

Radar

Some people can measure distance using radio waves. Radio waves travel well above ground. Some of the waves bounce back when they hit an object. This causes an echo. Radar is an electronic device that listens to echoes. Radar can find the distance to an object by measuring the time it takes to receive the echo.

The word "radar" stands for "radio detection and ranging." Radar is useful to keep airplanes from crashing into one another. Police officers use radar to measure the speed of moving cars. Space probes, which are unmanned vehicles, sometimes use radar to map the surfaces of other planets.



Sonar

Sound waves travel well underwater. Like radio waves, sound waves create echoes. This happens when they come in contact with an object. Sonar is a device that listens to the echoes of the sound waves. The word "sonar" stands for "sound navigation and ranging."

Like radar, sonar measures the time it takes to receive the echo of a sound. Then it calculates the distance to the object. Submarines use sonar to "see" underwater. Sometimes, people use sonar to find fish underwater. Oceanographers use sonar to map the ocean floor.



Entertainment

Many of the ways people have fun involve the use of technology. Entertainment includes listening to music on stereos, radios, or MP3 players. It includes watching television, taking photographs, and going to the movies. All these activities depend on technology. Stereos, radios, and televisions have electronic parts. Many cameras have mechanical parts. Video and computer games, movies, and music all require technology.

Stereos

People use a stereo to listen to music and other sounds. Technicians make stereos using specific electronic components. These components amplify sounds (make them louder). Other devices or components allow stereos to play compact discs and MP3s. They allow them to play records and tapes. Some stereos can take up an entire room. Other stereos are small. Portable stereos run on batteries. People can take portable stereos outdoors. Many people have stereos built into their cars. MP3 players are

THE HISTORY OF MUSIC RECORDING TECHNOLOGY



Phonographs or gramophones

were the most common devices for playing recorded sound from the 1870s through the 1980s. Its design changed numerous times during that period.



Phonograph records

began replacing the phonograph cylinders in the early 1900s. Phonographs are often called records, LPs, or 45s.



Stereo 8

, also known as 8-tracks, were created in 1964. They are a form of endless loop tapes.



Cassette tapes

were a primary form of sound recordings between the 1960s and early 2000s. Cassettes made it easier for people to make recordings at home.

TECHNOLOGY

small portable devices that can fit in a pocket. They can hold hundreds, or even thousands of songs.

Frequencies

Sound travels on sound waves. A sound wave has a frequency. The frequency is the number of times something moves in a second. A higher frequency sound has a high pitched sound like a whistle. A lower frequency sound has a low pitched sound like a drum. The amplifier is the main part of a stereo. It has different controls for changing the quality of how we hear the sound. The volume control adjusts how loud or soft the sound is. Bass controls make the low frequencies of sound louder or softer. Treble controls make the high frequencies louder or

softer. Some stereos have equalizers that can control many different frequencies. Balance controls make the sound louder or softer in the left or right speakers. People use a fader to make the front or back speakers louder or softer.

Stereo System

Stereo systems used to have many components and were generally quite large and took up a lot of space. Not to mention, they were not portable. Today, most people use their smartphones by hooking them up to a portable docking system which allows them to listen to music inside their homes, outside on a sunny day, in their cars, or even on trains and airplanes.



Compact discs, or CDs, have been used since the early 1980s. They are still popular today.



MP3 players are digital audio players (DAP). These small devices are unique because they can store and play music.



Smartphones are a perfect place to download and store your favorite music. All you need are some headphones and you can listen to music virtually anywhere you go..



Smartphone docking stations allow people to listen to music without headphones.

Sometimes, people listen to stereos using small speakers on their ears called headphones or ear buds.



Headphones or ear buds make it possible to listen to music without disturbing others.

Radio

Radio waves are a form of energy that travels through the air all around you. This type of energy is electromagnetic energy. These waves (signals) can carry sound, pictures, and other information over long distances. Radios are a type of device that uses radio waves. People often listen to the radio for news, information, music, and other entertainment. Many people have radios in their stereo systems at home or in their cars. The latest technology is satellite radio. It is a digital radio signal broadcast by a communications satellite.



Guglielmo Marconi (1874-1937)

Getting to know...

Guglielmo Marconi was born in Italy in 1874. He studied two types of science, physics and chemistry. Marconi read about Heinrich Hertz's transmission of electromagnetic waves across a room. Marconi realized that these radio waves could send messages through the air. They could do this without using wires. He performed experiments in his attic.

In 1896, Marconi obtained a patent for his invention of the radio. He also added a telegraph key that used Morse code. Marconi sent messages across the English Channel to France. The English Channel is part of the Atlantic Ocean. He showed how ships could use radio waves to communicate with other ships. They could also use them to communicate with people on the shore. Marconi found ways to increase the distance that radio waves could travel. Soon, he transmitted signals from England to Canada and Australia.

Radio Stations

Everything you hear on the radio comes from radio stations. A radio station broadcasts or sends music and other programs to a transmitting antenna. The antenna is high on a mountain, building, or tower. The antenna transmits the radio waves into the surrounding area. Small antennas in radios convert or change the radio waves into electric signals. When the electronic signals are amplified it produces sound. Different radio stations broadcast on different frequencies. You can tune into different stations on the radio to listen to different types of programs or music.



Towers with antennas for transmitting electronic signals can be found in almost every country of the world.

How Radio Waves are Transmitted

Radio stations can transmit radio waves in several ways. AM radio stands for amplitude modulation. This means that the strength of the radio wave is varied. FM radio stands for frequency modulation. This means that the frequency of the radio wave is varied. The short-wave is another type of radio wave. Short-wave radio can transmit over very long distances. Satellite radio is a new form of radio. This signal can cover a large geographic area.

Television

The first televisions had black and white pictures and you could only use them to watch shows broadcasted from television stations.

Television, or TV, is a source of both information and entertainment. Television stations can broadcast pre-recorded programs or live events as they are happening. Some live broadcasts, such as newscasts, are

produced in a studio. Other live broadcasts, like sporting events, are done away from a studio. They rely on a mobile studio and satellites.



Satellite trucks are mobile TV studios.

How Televisions Work

Televisions receive signals and then reproduce the signals into pictures and sounds. Televisions must have a screen for us to view the image and speakers for us to hear the sound.

Today, televisions are either analog or digital. Radio waves can carry both analog and digital television signals. Three different ways televisions receive signals are through the air, cables, and satellites.

Analog Televisions

Analog televisions use a cathode ray tube (CRT) to convert the pictures broadcast from a TV station into the image we see on the screen.



Words to know

frequency (free-kwen-see): In radio or electricity, the number of waves or vibrations per second



transmitted (trans-mit-ted): to send forward, to pass on or communicate

varied (vair-eed): changed or altered

TECHNOLOGY

The CRT uses beams of electrons to produce an image. Electrons are very small particles that you cannot see. The electrons light up red, green, and blue dots inside the screen. Electromagnets control the electronic beams and allow them to make a picture on the screen.

On February 17, 2009, all television stations in the United States will stop broadcasting analog signals.

Digital Televisions

Digital televisions (DTVs) have many advantages over analog televisions. Digital signals are electrical signals and can be compressed. Compressed digital signals can carry lots more information than analog signals. Digital televisions do not use a cathode ray tube to convert the signal into pictures. This makes the flat screen TV possible.

Another benefit of DTVs is that they can both receive and send signals. This makes it possible for you to send a message through your television to select a movie or show you want to watch. Many companies call this feature “on demand viewing.”

Digital televisions also have better picture quality than analog TVs. People refer to digital televisions as HDTV (high definition televisions). Not all digital televisions are HDTVs. HDTV

is the highest resolution level currently available for digital televisions.



Digital technology led to the development of flat screen TVs.

Devices Connected to Television Sets

Today, televisions have many different functions.

| DEVICE FUNCTIONS | |
|---|---|
| Aquos LCD TV: the technology utilizes a yellow fourth color subpixel |  |
| Digital Video Disc(DVD): plays programs |  |
| Digital Video Recorder (DVR): plays and records programs |  |
| Game Consoles: plays video games |  |
| Surround Sound: high quality audio system |  |

Cameras

People use cameras to record images (pictures) of people, places, and things. Some cameras take single still pictures showing one moment in time. Other cameras take several pictures together (movies) that record several moments together.

All cameras work by using a lens to focus light onto a surface. Some cameras capture the image on film while others capture the image digitally.

Still Cameras

Today, most still cameras have many automatic features and record the images digitally rather than on film. Some of the automatic features that make taking pictures a snap are auto flash and auto focus.

When the light comes through the camera lens, a sensor in the camera turns the light into electrons. The camera reads the electrons and creates the image out of tiny pixels. A pixel, or picture element, is one point in an

image. Many pixels make up each image.

Most digital camera sensors are a charge couple device (CCD). A few cameras use a complementary metal oxide semiconductor (CMOS).



In the past, when all cameras captured images on film, it could take several hours or days to develop the film and see your pictures. Digital still

Film

[Find out more](#)

Film cameras take photographs when an image remains focused on the film for a certain amount of time. This is the exposure. The aperture controls the amount of light that can come in. Exposure times are longer when there is not much light or the aperture is small.

Once exposed film is removed from the camera, it is then developed. Developed film is called negatives. We can print pictures from the negatives.



TECHNOLOGY

cameras have taken away the wait. You can take a picture and then view, print, or e-mail it almost instantly.

Video Cameras

Video cameras, or camcorders, take motion and record pictures. They are both a camera and VCR.



Sony made the first video camera for home use in 1983. These video cameras were much bigger than the camera the girl is using in this picture.



A few digital still cameras can also take short movies. Many people use the digital camera in their cell phone to take short movies.

Video cameras or television cameras use lenses to focus light. An electronic sensor converts the light to images. The camera records the pictures and then stores them on videotape, optical disk media, hard disk, or flash memory. You probably have home movies taken with a video camera that you view on your TV or computer.

VIDEO STORAGE DEVICES



Smartphone

optical disk media



flash memory



Motion Picture Cameras

Motion picture cameras take pictures one right after the other. The pictures are recorded on film at a rate of about 24 pictures, or frames, per second. This allows movements to appear smooth and lifelike when someone watches the film.

Movie producers usually use several different cameras to shoot a movie. The film from all of the cameras is then edited (put together) to create one film. Movie theaters use projectors to show motion pictures on a screen.



Cameras like this one are used to make movies.



Thomas Alva Edison (1847-1931)

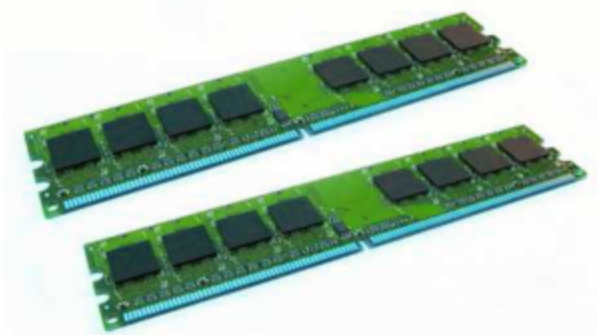
Getting to know...

Thomas Alva Edison was born in Ohio in 1847. As a boy, he worked at a railroad station selling newspapers and candy. Edison found a job as a telegraph operator. Then he decided to become an inventor. In 1876, he opened a research laboratory in Menlo Park, New Jersey.

Edison improved many existing devices, like the telegraph. Edison invented the phonograph. This is a device for recording sound as grooves on a spinning cylinder. This invention made him famous. People called him the "Wizard of Menlo Park." He developed a motion-picture camera. It could record and play back visual images. People most often recognize the name Edison for his electric lighting system. He did not invent the light bulb, but he improved it.

Computers

A computer is an electronic device that stores data, or information. It also retrieves and processes or sorts information. People can program a computer to help complete many different tasks. Computers use a combination of hardware and software. **The hardware** is all the electronic components that make up a computer. For example, a mouse is hardware. **Software** is the instructions that tell a computer what to do. Sometimes, people use the term program to describe these instructions.



If your computer seems to be working slowly, you may need to buy more RAM to put in your computer.

Central Processing Unit

All computers use a central processing unit, or CPU, to process information. A CPU is made of thousands of tiny electronic circuits. The CPU processes instructions and then sends out a result.

Many computers have ROM chips

that provide instructions to the CPU. ROM stands for read only memory. Many computers also have RAM chips that store information. RAM stands for random access memory.

Programs stored in RAM can also send instructions to the CPU. Other data can be stored in RAM temporarily. A computer loses all the information stored in RAM when someone turns the machine off. Most personal computers have more RAM memory than ROM memory.



ATM machines give people access to their bank accounts 24 hours a day.

Dedicated Computers

Some computers do only one thing. This type of computer is a dedicated computer. Automatic teller machines, or ATMs, contain dedicated computers. These computers let people check their bank accounts and withdraw money.

Computers in Our Everyday Lives

Computers are all around you. Small computers may tell you when an oven is hot. Computers in cars help engines run smoother. They also tell the driver when there is a problem. Many televisions use computers to change channels, or to turn them on and off. Some toys have computers that allow them to talk or make noises. Computers are an essential part of modern technology.

Personal Computers

A personal computer, or PC, is a computer that can perform many different functions. People use personal computers at home, in school, and for business.

Personal computers have many components or parts. Electronic circuits inside a PC process information. PCs also perform calculations, such as adding or dividing. All personal computers need a CPU, ROM, and RAM. Many other peripheral devices can connect to a PC.

Most personal computers have a few USB (Universal Serial Bus) ports



Business people often use handheld computers to keep track of appointments and read e-mails when they are away from the office.

that let you plug in peripheral devices. For example, many digital cameras and printers connect to your PC through a USB port.

Drives

Computers use hard disk drives, or hard drives, to store software and data. They also use hard drives to retrieve information. Most hard drives have hard disks inside the central processing unit that are permanent. That means you can not remove the hard drive without taking the computer apart. Some hard drives have removable hard disks.



In most libraries, people use computers to see if the book they are looking for is available or to view it online.

Most personal computers have a CD or DVD drive that can read and write onto CDs or DVDs. Flash drives are smaller than hard disks. They are about the size of your thumb. They can not store as much information. Both hard drives and flash drives store information by magnetizing tiny parts of a disk. When you magnetize something it acts like a magnet and



Flash drives plug into your computer through a USB port.

attracts iron or steel. Information can be lost if a magnet comes too close to the disk.

CD-ROM Drives

CD-ROM drives use a laser to read information on special compact discs called CD-ROMs. A CD-ROM can contain a lot of information. You are not able to erase the data on a CD-ROM.

Monitor, Keyboard, and Mouse

A monitor is a screen like a television. It shows the information that the computer is processing. People use a keyboard to type information into a computer. Most keyboards have the entire alphabet and numbers zero through nine. They also have several other keys for symbols and special functions. You can use a mouse to select information on the screen. The mouse moves a symbol on the screen called a cursor.



Printers

People use a printer to make a printout, or paper copy of information displayed on the monitor. There are many different kinds of printers. Some



Today, many people connect their computer to their printers using Wi-Fi.

print in black and white. Others print in color. Ink-jet printers and dot matrix printers print with ink. Laser printers use toner to make an image on paper. Toner is like powder.

Find out more 

Computers Get Sick Too

Sometimes, computers have bugs in their programs. Bugs are errors in a computer program. Something called a virus can infect a computer. Viruses are little programs that cause big problems in other programs. Bugs and viruses cause computers to crash, or stop working.

Network

A network is a way to link together many computers. A network allows different computers to share information with each other. Many computers on the same network can share the same printer.

People use a device called a router



Steve Jobs (1955-2011)

Getting to know...

Steve Jobs was born in San Francisco, California in 1955. When he was young he worked for a company called Atari. This company made video games. When Jobs was only 21, he formed the Apple Computer Company. He worked with Steve Wozniak. The company built personal computers. It helped to make the personal computer very popular. Jobs was one of the first inventors to introduce a computer that used a mouse. This was in the early 1980s. This helped to make personal computers easier to use by the average person.

For a short time, Steve Jobs left Apple Computer Company. Jobs then went back to work for Apple. He is now the CEO. Under his leadership Apple has recently made the MP3 player popular. Two of their MP3 products are the iPod and iTunes.

to connect their network. Networks can be connected through the router with cables or with Wi-Fi.

The Internet

The Internet is an electronic communications network that connects millions of computers around

the world. It allows people to share information between computers and communicate with people through their computers. Most people connect their personal computers to the Internet. The connection can be a physical connection using phone lines or cable lines or it can be a wireless connection (Wi-Fi).

HOW A HOME COMPUTER CONNECTS TO THE INTERNET



INTERNET BASED TECHNOLOGIES

E-mail (electronic message) is a way to send and receive messages electronically. The messages are saved and can be read whenever the recipient wants to read them.



IM (instant messaging) is like a conversation between two people using text. The communication is in real-time.



Videoconferencing is a way for people in different locations to meet and talk using video and audio.



VoIP (Voice over Internet Protocol) is a way to carry voice conversations over the internet. VoIP uses phones that look like traditional telephones.



Web (World Wide Web) is a part of the Internet. A person uses a web browser to see interlinked and hypertext documents.



Wi-Fi (Wireless Fidelity) is the common term for wireless local area networks. Wi-Fi is used for Internet access as well as many other things such as gaming and television.



Find out more 

Calculators

Calculators are small general purpose computers that can do calculations. The basic functions of a calculator are addition, subtraction, multiplication, and division. After you type in your mathematical problem, the calculator displays an answer almost instantly.

Scientific calculators can perform more complex calculations. They have extra function keys for doing simple algebra and geometry. Some people program scientific calculators to solve mathematical equations. These equations have many calculation steps.



With the development of the smartphone, most people can access a calculator without even owning one. Just tap the icon on your phone and you have your calculator right at your fingertips!

Robots

Robots are devices that perform specific tasks. For example, robots can put parts in a car. People use computer programs to control robots.

The programs tell them what to do. Sometimes, people can control a robot directly. They use a remote control to make the robot work.

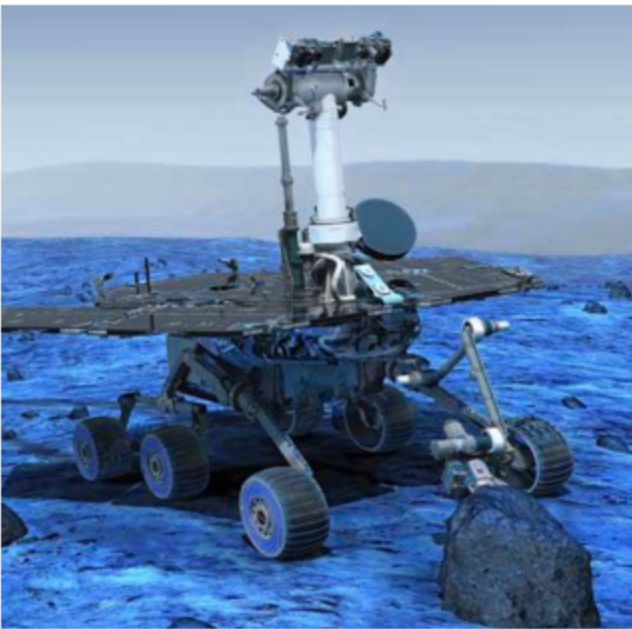


Robots used to build cars still require people to program and maintain them.

What Robots Can Do

People use robots to help build things. These robots perform the same tasks over and over. Sometimes they do jobs that are too complicated or hard for humans to do. Computers control the movements of these robots.

Some robots do jobs that are too boring for people. Other robots perform tasks that are too dangerous for people to do. For example, they may search for bombs. Robots also go places and do things that humans cannot. For example, robots explore the surfaces of other planets.

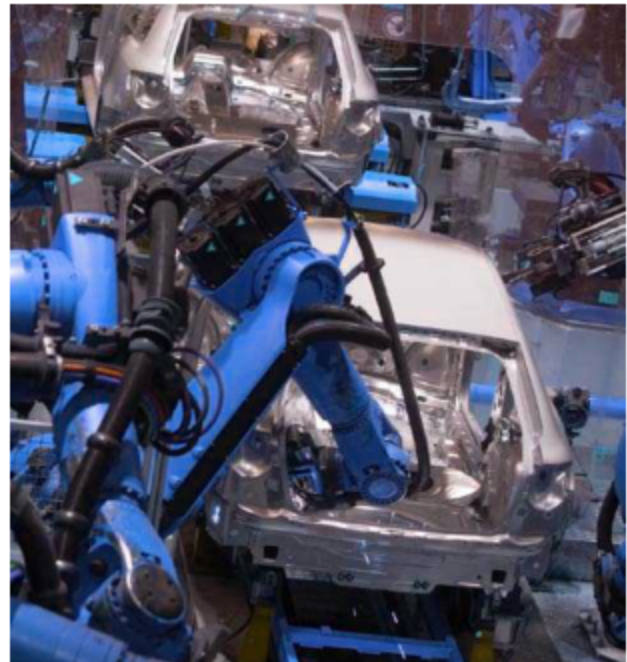


The Mars Rover Robot has helped us learn more about planet Mars.

Robot Parts

Robots have various parts that help them do their jobs. Robots may have attachments or parts that anchor

them to the ground or they may roll around on wheels. Some robots have mechanical arms to pick things up. Despite what you may see in movies, most robots look more like machines than people.



Almost all cars are made using robots.



Toys can also be robotic.

People Who Use Technology

What did you do today? Did you talk on the telephone? Did you ride in a car or on a bus? Did you use a computer or turn on a light? If you did any of these things, you used technology.

Almost everybody uses some form of technology at work, home, or school. Computer programmers use computer technology to write a computer program. People may write letters using a computer program called a word processor. Many people work in the entertainment industry. Camera operators use television and motion-picture cameras. They use them to make TV shows and movies. Disc

jockeys, or DJs, play records and CDs on the radio.

Scientists use all sorts of technology to study the Earth and the Universe. Businesses often have telephones, fax machines, and computers. Graphic designers use desktop publishing programs to create books and magazines. Doctors frequently use medical technology. They use it to treat injuries, illnesses, and diseases such as cancer. Pilots fly airplanes and helicopters. Who knows what jobs will be created by new technologies in the future!

OTHER AMAZING TECHNOLOGY

Technology

Global Positioning System (GPS)



Imax film
(short for Image
Maximum)



Used For

GPS is used by the military to navigate and coordinate the movement of troops and supplies. Civilians use them as navigation tools in their cars.

Imax film can display images of far greater size and resolution than conventional film display systems. A standard IMAX screen is 72.6 feet (22m) wide and 52.8 feet (16.1m) long.

OTHER AMAZING TECHNOLOGY

Technology

Used For

Night vision device (NVD)



NVD allows images to be produced in levels of light approaching total darkness. They are most often used by the military and law enforcement agencies.

Remotely operated underwater vehicles (ROVs)



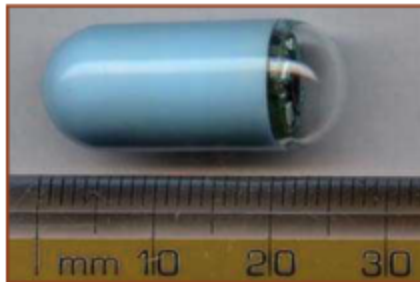
ROVs are used by the Navy to perform deep-sea rescue operations and recover objects from the ocean floor, and by the science community to study the ocean.

Thermography, thermal imaging, or thermal video



When viewed by a thermographic camera, warm objects stand out well against cooler backgrounds. They are used by security and military people. Firefighters use it to see through smoke.

Video Pill



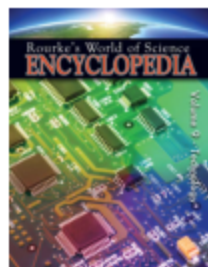
Video pills are cameras the size and shape of a pill. Patients swallow the video pill then a doctor can look at their gastrointestinal tract.

Virtual reality (VR)



VR allows a person to interact with a computer-simulated environment, either through the use of standard input devices such as a keyboard and mouse, or through multimodal devices such as a wired glove.

Book Index



Rourke's World of Science Encyclopedia

Rourke's World of Science Encyclopedia *Nancy Harris. Vol. 9: Technology. 2nded. Vero Beach, FL: Rourke Educational Media, 2016. 64 pp.*

Teaches the essential concepts for elementary school science instruction. Topics include the basic objects in the sky, life-cycles, and properties of earth materials to the more advanced, structures of living systems, forces and motion and science technology. This volume covers technology.



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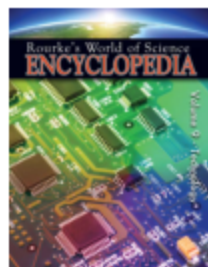
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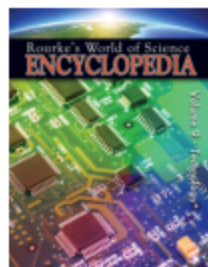
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Rourke's World of Science Encyclopedia

Rourke's World of Science Encyclopedia *Nancy Harris. Vol. 9: Technology. 2nded. Vero Beach, FL: Rourke Educational Media, 2016. 64 pp.*

Teaches the essential concepts for elementary school science instruction. Topics include the basic objects in the sky, life-cycles, and properties of earth materials to the more advanced, structures of living systems, forces and motion and science technology. This volume covers technology.



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