CHAPTER 14

ACTIVITIES

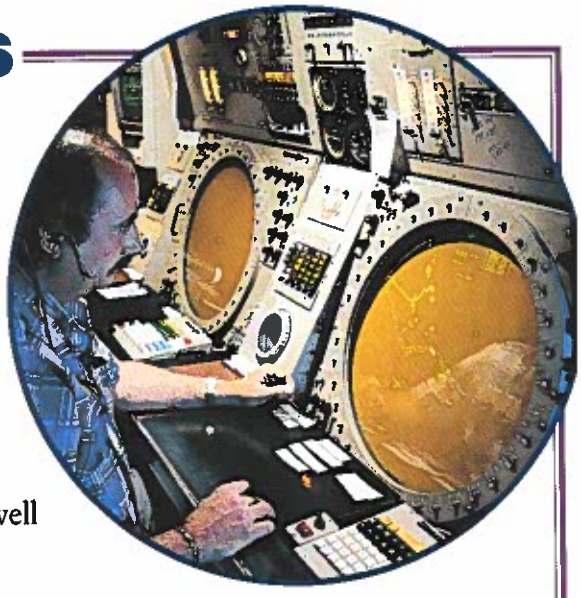
CROSS-CURRICULAR EXTENSIONS

1. MATHEMATICS Find the relationship between the area of the hovercraft and its carrying capacity.

2. SCIENCE Design a method for measuring the drag (air resistance) on an object such as a model airplane, car, or rocket. Try your idea in the wind tunnel. Can you make a general statement that would apply to all shapes and the amount of drag they encounter?

3. COMMUNICATION Ask one of the following resource people to speak to your class: airline pilot, railroad engineer, air traffic controller, automobile race driver, or test driver.

EXPLORING CAREERS



Technology has changed the way people order, ship, and track the delivery of products. This fast-paced field includes new careers, as well as many that have been around for some time.

Air Traffic Controller Air traffic controllers control the movement of air traffic to make sure that planes keep a safe distance apart. Some controllers are responsible for traffic around a single airport and others handle flights between airports. Air traffic controllers must be able to work well under pressure and be able to give clear instructions.

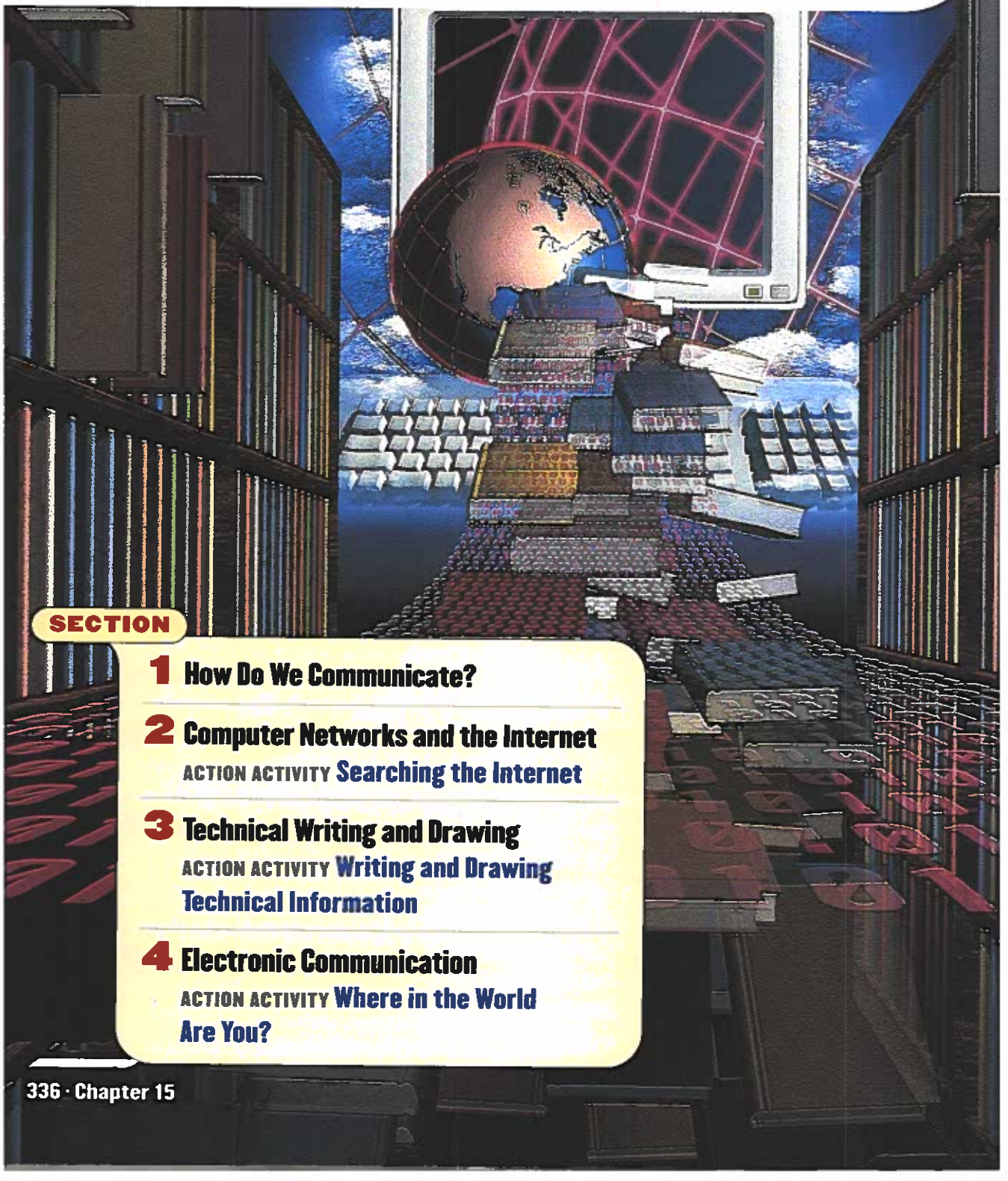
Diesel Mechanic Diesel mechanics and service technicians repair and maintain the diesel engines that power heavy vehicles such as trucks, locomotives, and bulldozers. They perform routine checks to prevent problems from occurring. Diesel mechanics use a variety of tools, including handheld computers, power tools, and hand tools. They must be able to interpret manuals and stay up to date on new engine components.

ACTIVITY

You must transport a truckload of oranges from Los Angeles, California, to Burlington, Vermont. Plan the route and method you would use. Explain your choices.

CHAPTER 15

Finding & Using Information



SECTION

How Do We Communicate?

SECTION 1

THINGS TO EXPLORE

- Define communication and give examples of how we communicate.
- Explain how a communication system works.
- Identify technologies used in communication.

TechnoTerms
communication
electronic noise
interference

Can you imagine your world without television, telephones, books, signs, newspapers, tape recorders, or computers? It would be pretty hard to go through a day without using any form of communication. What is communication? **Communication** is the process of exchanging information either by sending it or by receiving it. Fig. 15-1.

Sometimes your message is sent to another person; an animal, such as your dog; or a machine, such as a robot. Sometimes, even machines communicate with other machines, such as one computer to another. But before you are really communicating, the message has to be sent, received, and understood.

Fig. 15-1. Television is a powerful communication tool. What kinds of information does television bring us?

OPPOSITE Books, computers, and other resources are like banks that store thousands of years worth of human knowledge.

TechnoFact

SELL, SELL, SELL
Advertisers will try almost anything to get their message across to possible customers. A new communication system that connects to a phone line delivers advertisements between the rings of a telephone call. Now that's making every advertising second count!

In this chapter, you will explore different ways to communicate, from using the Internet, to technical writing and drawing, to using communication satellite technology. As you read the chapter, think about the ways you and your family use technology to communicate. How does technology help you stay in touch with friends and relatives?

Parts of a Communication System

A communication system is like any other system. It has input, a process, and output. The *sender* creates the input, or message. The process is how the message is sent. The output is the form of the message that the *receiver* gets. Feedback from the receiver lets the sender know if the message was understood. Fig. 15-2.

INFOLINK

See Chapter 8 for more information on systems.

There is always a chance for interference anywhere in a communication system. **Interference** is anything that gets in the way of the message being understood. For example, sometimes it is hard for people to communicate if they do not understand the same language. Other forms of interference might be **electronic noise** such as static. A scratch on a record or a CD can also cause noise interference.

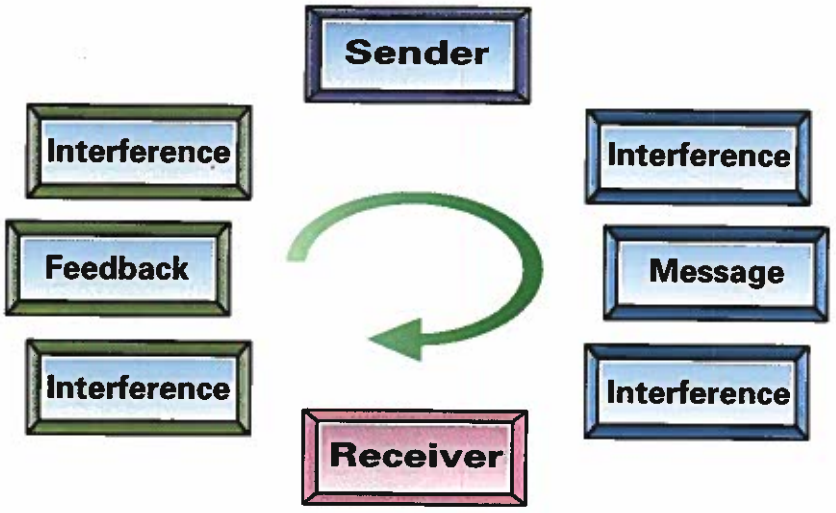


Fig. 15-2. The communication process makes a complete circle, from sender to receiver and back to sender. How does a teacher receive feedback from students?

Technology Brings Change to Communication

People have been communicating with each other since ancient times when they first used signs and symbols. Today, communication is changing very quickly. That's because we are developing new technologies that help us communicate in many exciting ways. You can communicate with digital photography, animation, and video. You can also use devices such as a *laser* (*l*ight *a*mplification by *s*timulated *e*mission of *r*adiation) in a laser disc player or CD player.

INFOLINK

See Chapter 5 for information about digital photography, animation, and video.

Did you ever think you would see a laser being used to get information at a grocery store? You have seen bar codes—a series of black lines and white spaces—on products. When you buy an item, a laser inside an optical scanner at the checkout counter reads the bar code. The scanner laser senses the lines and spaces and changes the information into on or off pulses of electricity. Each product has its own code. The code is sent to a computer, which then gives the price for that item. Bar codes help store owners in many ways. The computer can use the bar codes to keep track of price changes, how many of that item are in stock, and to let the store know when it's time to order more.

TechnoFact

LASERS ARE EVERYWHERE

Lasers have been around for a long time. The first laser was made by Theodore Maiman in 1960 using a ruby rod with mirrors at both ends. Today's lasers use materials such as helium, neon, argon, carbon dioxide, or organic dyes to produce different wavelengths of light. Lasers have become common in many applications: supermarket checkouts, laser disc players, CD players, optical data storage for computers, computer printers, and laser surgery.

SECTION 1 TechCheck

1. What is communication?
2. Explain how a communication system works.
3. List three technologies that help us communicate today.
4. **Apply Your Knowledge.** Research how a laser works. Report your findings to the class.

SECTION 2

Computer Networks and the Internet

TechnoTerms

- e-mail
- Internet
- network
- search engine
- uniform resource locator (URL)
- World Wide Web (www)

THINGS TO EXPLORE

- Describe what a computer network is.
- Tell what the Internet is and how it works.
- Explain how a search engine works.
- Search the Internet for specific information.

Another very important way to communicate uses computers. When you connect computers together you create a **network**. When you connect many computers together, like in a school or office, it is called a *local area network* or *LAN*.

LANs often use a main computer to provide information to other computers on the network. The main computer is called the *server* and the other computers are called *clients*.

What Is the Internet?

If you take thousands of LANs and millions of home computers and connect them together, you have the world's biggest network, called the **Internet**, or "the Net."

The Internet actually started as a military communication system to be used in case of a nuclear war. It then expanded into a method for scientists to share information. Today, millions of people use the Internet to order products and send messages electronically using **e-mail** (electronic mail). Fig. 15-3. All of the words and many of the illustrations in this book were sent to the publisher using e-mail. Have you ever sent an e-mail message?

Fig. 15-3. E-mail is also used by electronic "stores" to send you a record of your purchase. Have you ever purchased a product online? If so, describe your experience.

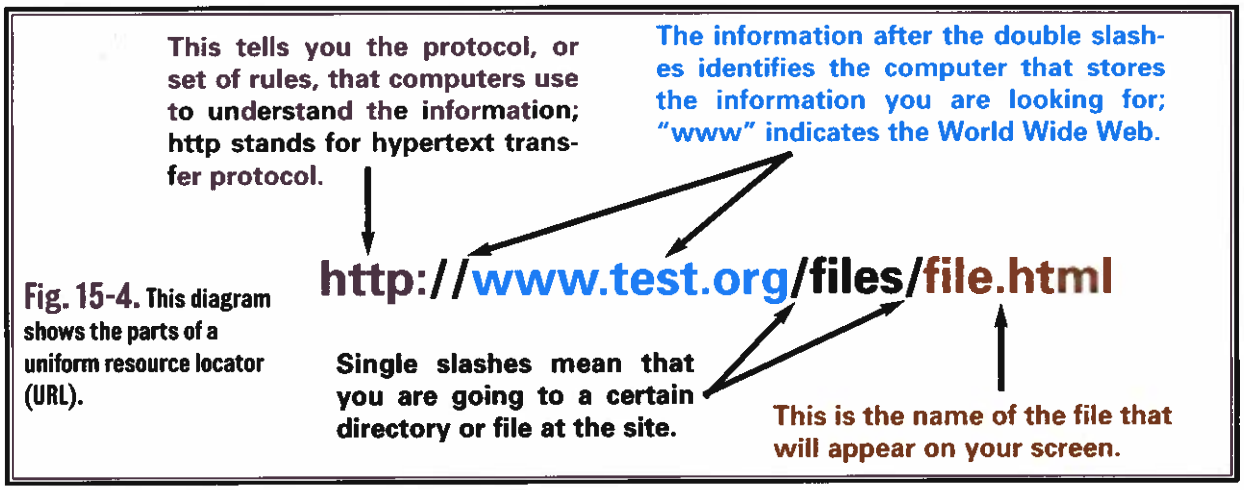


Fig. 15-4. This diagram shows the parts of a uniform resource locator (URL).

The **World Wide Web** (**www**) is part of the Internet developed to present Internet information in a format that is easy to use. Because of this ease of use, the Web has become very popular.

Websites Many businesses, companies, schools, and even individuals have a location on the Web called a *website*. Websites are made up of web "pages" that are created on computers. A website can be found using its address, or **URL** (**uniform resource locator**). Fig. 15-4. URLs also make it easy to link pages together.

Making a web page is easy. Ask your teacher if you could make a web page for your technology education class.

Searching Made Easy People use software called browsers to access the Internet. Netscape and Internet Explorer are examples of browsers. Once you are connected, you can find information using **search engines**. Search engines take a key word or phrase and find matching files for you to view.

TechnoFact

HYPERSTUFF

"Hyper" words are used to describe the way the Web works. Here are a few. HTML (hypertext markup language) is the language used to write web pages. Hypertext is a system of writing and displaying words so they can be linked in many ways. Web pages are transferred over the Net using http (hypertext transfer protocol). Pictures, sounds, video clips, and animations seen on the Net are called hypermedia.

SECTION 2 TechCheck

1. What is the Internet?
2. How do you search for information on the Internet?
3. What is a network?
4. **Apply Your Knowledge.** With your teacher's help, find the latest information on the next space flight planned by NASA. Print the results of your search and post the information on the bulletin board or print it in the school newspaper.

SECTION 2

ACTION ACTIVITY

Searching the Internet

Be sure to fill out your TechNotes and place them in your portfolio.

Real World Connection

Have you ever searched for a book in the library only to find that it was already checked out? Have you ever talked with your parents or friends about the latest news and wondered how they heard about something that you knew nothing about? The Internet has quickly become the first source of information for millions of people around the world. In this activity, you will learn to search the Internet for specific information. Fig. A.

Design Brief

Use a search engine on the Internet to find information on a technology-related topic. Refine your search so it will be limited to only the specific information you are looking for. Put the information you find into a report or computer presentation.

Materials/Equipment

- computer with network or modem connection to the Internet
- word-processing software
- printer
- presentation software (optional)

SAFETY FIRST

- **Follow the safety rules listed on pages 42-43.**
- **Check with your teacher to see if you and your parents need to sign an agreement for appropriate use of the Internet in school. Like the real world, the Internet is full of exciting things, but some of them are not appropriate for everyone. Make sure you have teacher permission and supervision while you use the Internet.**

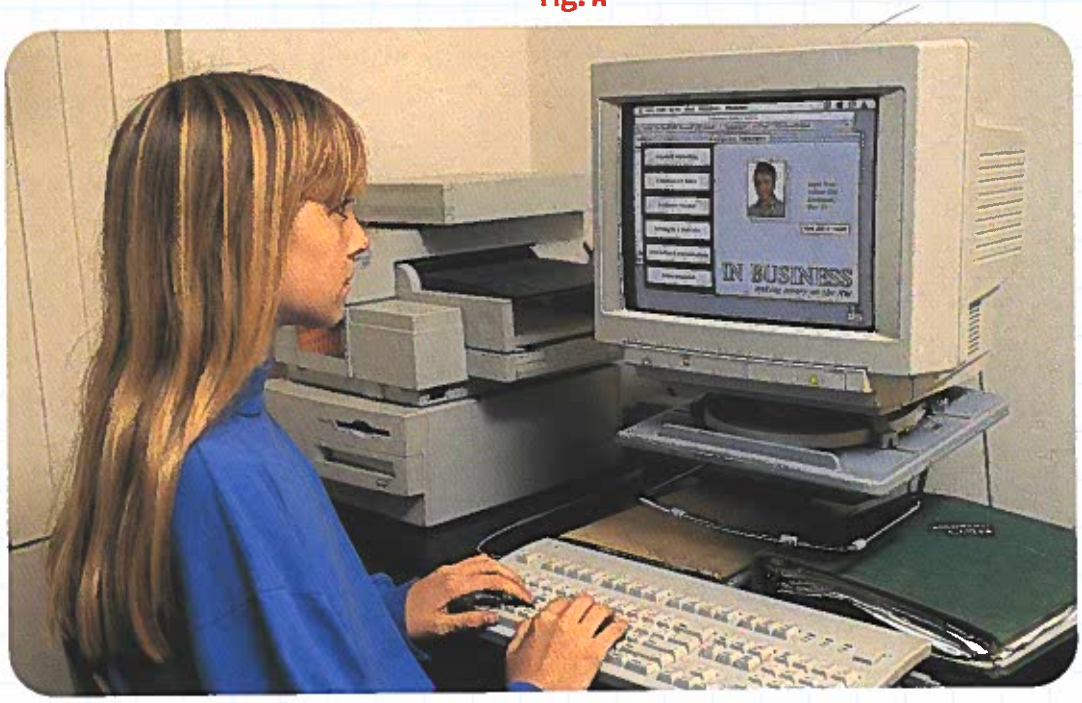
Procedure

1. Choose a topic related to technology that interests you. Here are some ideas:
   - Mars exploration
   - automobile crash testing
   - mountain bike design
   - wind surfing
   - microgravity
   - surfing conditions
   - snowboard designs
2. Boot your computer and start a browser such as Netscape or Internet Explorer.
3. Click on "Search" and type a key word or phrase in the appropriate box. Start the search and look at the number of matching files.
4. View the matching files and choose the ones that most closely match your needs.
5. Read the information and evaluate it. Remember to compare information from different sources in your evaluation.
6. Copy and paste images from your search results into a word processor for a printed report or into presentation software for a computer presentation.

Evaluation

1. List the names of three search engines.
2. Why is it important to know how to search for information on the Internet?
3. What do you think might happen if the Internet stopped working?
4. How do your parents or teachers use the Internet?
5. **Going Beyond.** Check with your teacher about creating a set of Internet "bookmarks" (URLs saved to the browser) related to your topic that others can use for further information.
6. **Going Beyond.** Research the weather for your area on the Internet. Print a weather map and forecast each day and post it in the school office for others to see.

Fig. A



SECTION 3

Technical Writing and Drawing

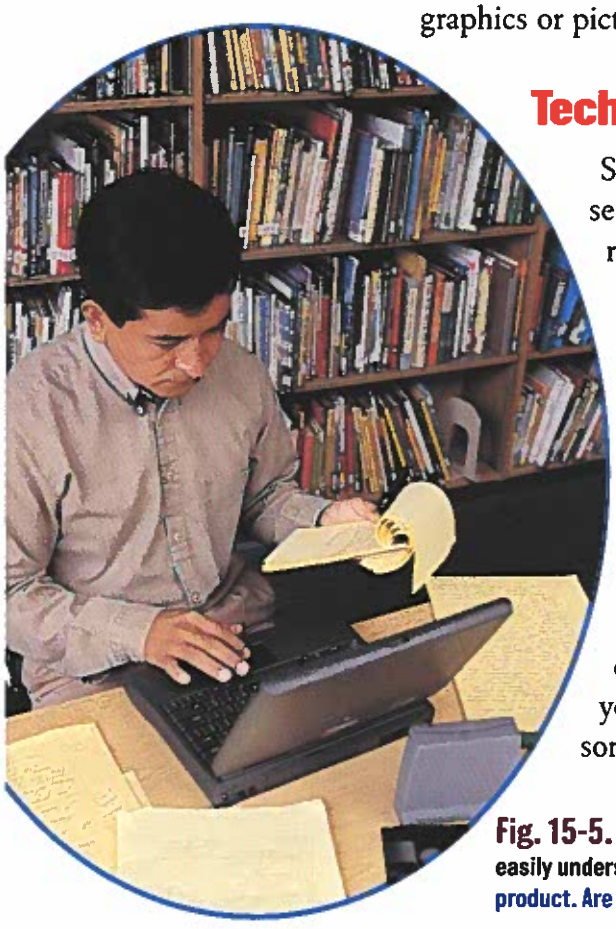
THINGS TO EXPLORE

- Explain what technical writers and technical illustrators do.
- Identify the three types of pictorial drawings.
- Describe how computers help the process of writing and drawing.
- Create a procedure using technical writing and drawing skills.

TechnoTerms

edit
isometric drawing
oblique drawing
perspective drawing
technical illustrator
technical writer

Have you ever tried to put together a model of a rocket or use a computer software program only to get frustrated trying to follow the written directions? It isn't easy to write instructions or manuals that everyone can follow. Adding graphics or pictures is one way to make directions clearer.



Technical Writing

Sometimes when you are writing directions, they seem crystal-clear to you, but when other people read them they get confused. Even writing directions for making a peanut butter and jelly sandwich is not as easy as you may think. If someone had never seen a sandwich before, your directions would have to include how to put the two pieces of bread together!

Technical writers are trained to write technical manuals and instructions. Fig. 15-5. They have people test their instructions to make sure they haven't left out a step that they assumed everyone else already knew. In order to make sure your own messages are clear, you should have someone else **edit**, or check and correct, your work.

Fig. 15-5. The main goal of technical writers is to make material easily understood. Find an example of directions that come with a product. Are they clear? How could they be improved?

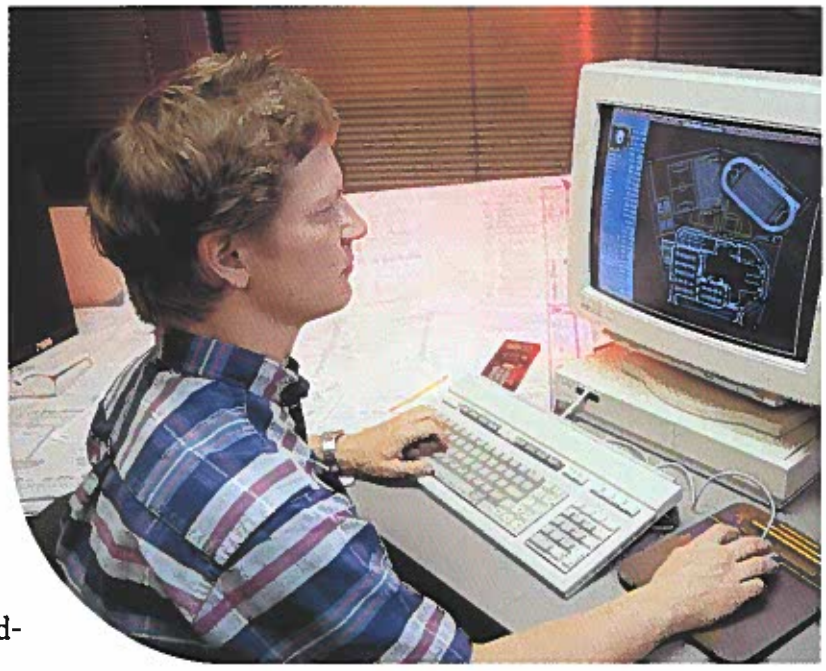


Fig. 15-6. The drawing done by a technical illustrator can make instructions easier to understand. Find an example of instructions in a how-to book in which a drawing plays an important part. Show the drawing to the class and explain its value.

Computers have made the editing process much easier than it used to be. If there are things that need changing in your instruction manual, a word-processing program will let you change them easily as well as check spelling and grammar.

Technical Illustration

Anytime you can use pictures or drawings to back up the words in a manual, the information will make will make more sense to more people. Technical drawings or illustrations help people understand the sizes and shapes of objects. **Technical illustrators** are people skilled in making this type of illustration. Fig. 15-6. Technical illustrators show objects in either pictorial or orthographic drawings.

Kinds of Pictorial Drawings A pictorial drawing shows a three-dimensional view of an object. There are three kinds of pictorial drawings. Fig. 15-7A.

- **Isometric drawings.** These drawings show an object as if you were looking at it from an edge. The object is angled and tilted slightly toward you. Lines that show the width and depth of the object are drawn at 30° angles from the horizontal.
- **Oblique drawings.** These drawings show one surface as if you were looking straight at it. Two other surfaces are shown at an angle.
- **Perspective drawings.** These are the most realistic drawings. Parts of an object that are farthest away look smaller.

INFOLINK

See Chapter 12 for more information about pictorial drawings.

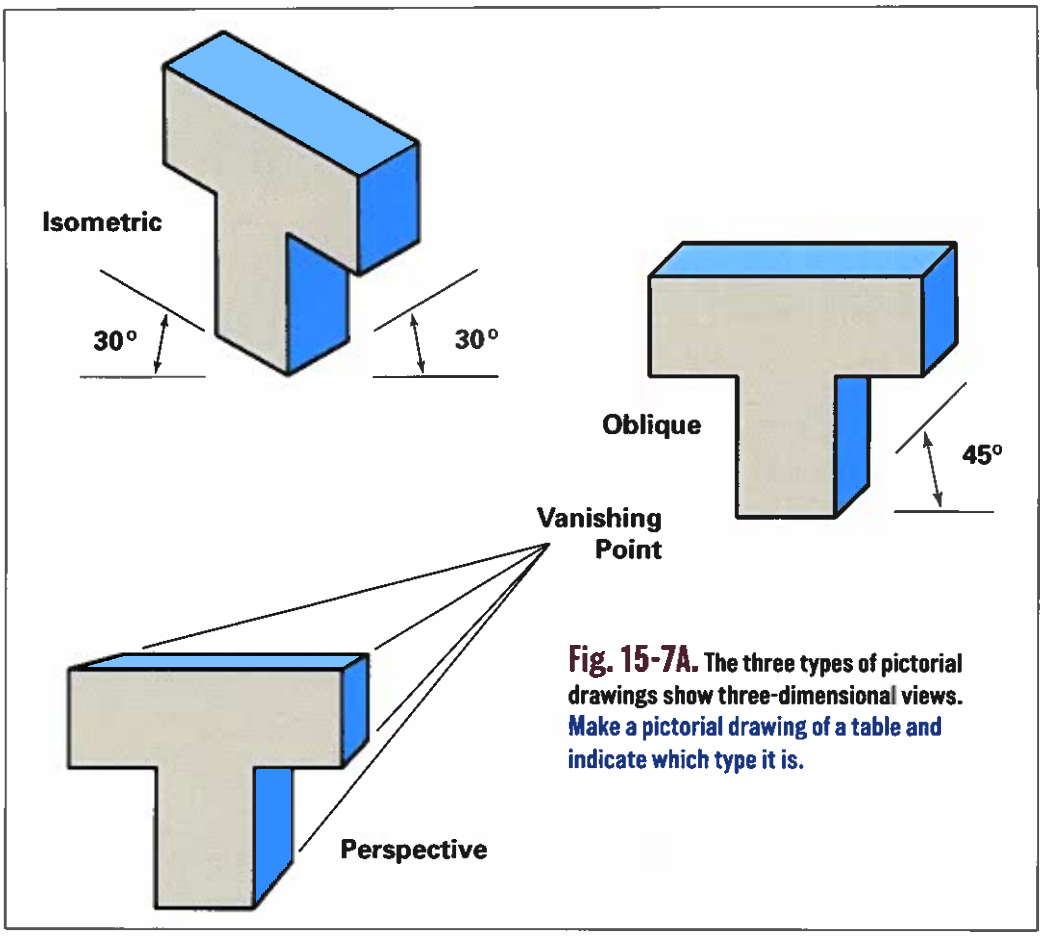
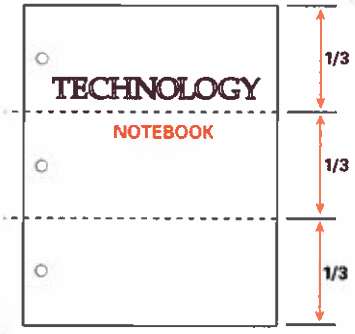


Fig. 15-7A. The three types of pictorial drawings show three-dimensional views. Make a pictorial drawing of a table and indicate which type it is.

COMMUNICATION CONNECTION

How Ads Get Your Attention

What catches your eye first when you look at a billboard, a magazine ad, or a picture in a book?



You look at so many different things in a day that it is really a challenge for graphic artists to catch your attention. If you're going to communicate well with pictures and symbols, you need to do some of the things graphic artists do.

- **The line of golden proportion.** You can find the line of golden proportion by dividing the height of your drawing paper into three equal sections. The line one-third down from the top is the line of golden proportion. Half of any text or graphic should be above this line, and half should be below this line. If you arrange your pictures or writing this way, it

Orthographic drawings are another way to show an object. Here three views (usually the top, front, and side) of an object are shown as if you were looking straight at each one. Orthographic drawings are useful because they show the exact shape of each view. They also show how the views relate to each other. For example, in Fig. 15-7B, note that the top view is directly above the front view.

INFOLINK

See Chapter 12 for more information about orthographic drawings.

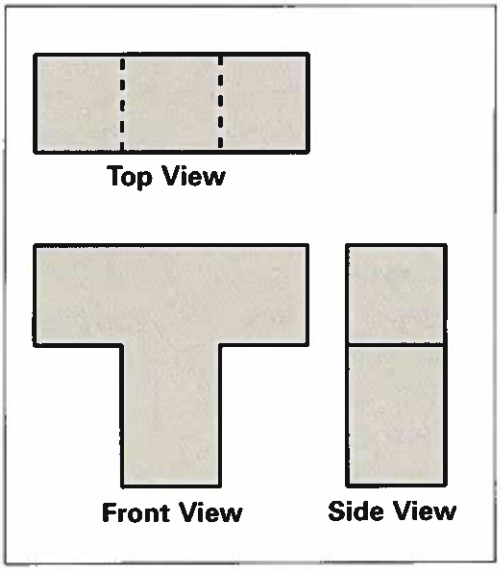


Fig. 15-7B. Orthographic drawings show views of an object. The dashes in the top view are "hidden" lines. They show the location of this object's base, even though you could not see the base when looking at the top.

makes them much more interesting. This method is also called the "rule of thirds."

- **Rhythm.** Rhythm guides the viewer's eyes toward a certain area. Sometimes you might number items to guide the eye. Other times you might use arrows to guide the eye to a specific spot in the picture. In a photograph, shadows can guide the eye to different areas.

- **Unity.** Unity is present in an ad when everything works together. For example, if you use too many different type styles or sizes in one ad, it looks confusing. If you are adding graphics, you need to think about how they fit your message.

ACTIVITY

Make an ad for your school athletic department.

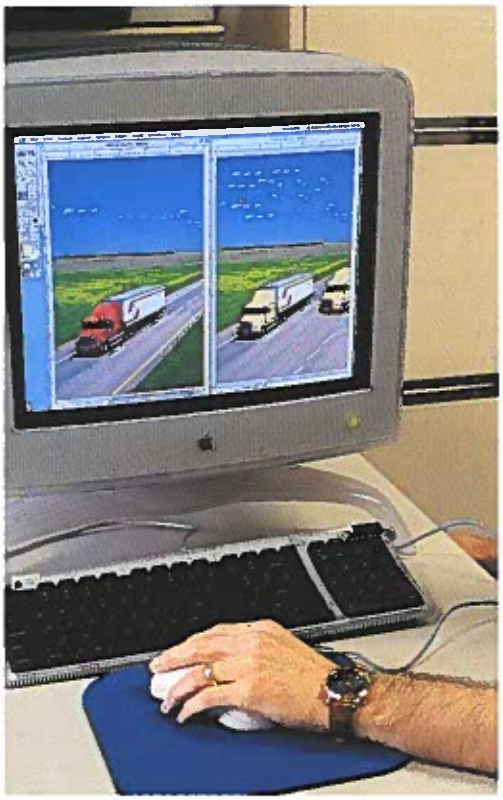


Fig. 15-8. The photo on the left is the original. On the right is the altered version. What has been changed?

How Computers Help Computer-aided design (CAD) has improved technical drawing. CAD allows technical designers to create very precise, or accurate, drawings that are easier to edit than hand drawings. Then the drawings are printed. Making drawings that are realistic is also important in communicating an idea. Graphic artists can electronically create exciting posters or magazine layouts all on the computer screen.

Graphic artists used to have to work long hours to put photographs, artwork, and text together. Desktop publishing lets you put text and graphics together easily. Changes can also be made easily. A special effect can be added to a regular photo. That photo can then be added to another picture using a *digital image processor*. Fig. 15-8. For example, you could combine a picture of yourself with a picture of the beach even if you've never been there! In animation, graphic artists need to create a character or scene only once, save it on the computer, and call it up for changes in each scene.

INFOLINK

See Chapter 5 for more information about desktop publishing.

SECTION 3 TechCheck

1. What do technical writers and illustrators do?
2. Why is it difficult to write clear instructions?
3. Name the three types of pictorial drawings.
4. How do computers help technical writers and illustrators?
5. **Apply Your Knowledge.** Check the manual that comes with your home or school VCR or television. Is it easy to use? How could you change it to make it better?

ACTION ACTIVITY

Writing and Drawing Technical Information

Be sure to fill out your TechNotes and place them in your portfolio.

Real World Connection

You know how frustrating it is when you don't understand directions or the directions don't make sense. Now you have a chance to write a procedure clearly and completely so anyone can understand it. In this activity, you will be working both as a technical illustrator and a technical writer.

Design Brief

Write a procedure for drawing an object located in your classroom. Your written instructions will be given to another technology student in another class. That person will follow your procedure, compare his or her drawing with your original drawing, and evaluate your instructions.

Materials/Equipment

- paper, pencil
- drafting equipment
- computer with CAD and word-processing software (optional)

SAFETY FIRST

Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.

Procedure

1. In this activity, you will work individually. Choose an object that is visible in your classroom. The object should be recognizable from a front view.
2. Use drafting tools or CAD software to make a front view of the object. Keep your drawing simple. You may need to leave out some details and make only an outline. You should draw in just enough detail so the object can be recognized easily.
3. Ask someone else in the class to look at your drawing. Can it be identified easily? If not, you need to refine your drawing or put in more detail so there won't be any confusion.
4. Next, write directions for another student (in another class) to make a drawing exactly like yours and to identify the object.

(Continued on next page)

ACTION ACTIVITY

5. Write the directions on paper or use word-processing software. Create them carefully so both drawings will be identical. Keep in mind that sometimes a direction can have more than one meaning. Then it is called *ambiguous*. As you follow these sample directions, check for ambiguous directions. Fig. A.

Are These Directions Clear?

- Tape the paper to a drawing board so the long edge is parallel to the T-square.
- Starting from the upper left corner, measure 5 1/2" to the right and 1" down. Mark this position as point A.
- Draw two 75°-angle lines, 1/2" long, down to the left and right of point A.
- Join the end of the lines in step 2 with a horizontal line, forming a triangle.
- From the lower corners of the triangle, draw two parallel vertical lines 4 3/4" long.
- Join the lines with a short horizontal line to complete the outline of the object.

Fig. A

6. Compare your drawing with another student's work. Could yours be improved?
7. If you used CAD software to make your drawing, your directions will be slightly different. In this case, you should include such things as scale and screen position. The hard copy (printout) of both drawings should be identical if your directions were clear and accurate.

Evaluation

1. Ask your teacher to give your directions to a student in another class. Compare the results of the drawing made from your directions with your original. Are they the same?
2. Were there any ambiguous directions in your list? Explain.
3. How do you think directions could be made simpler for very complex tasks?
4. **Going Beyond.** Make a pictorial drawing of your object rather than the front view. Was it easier or harder to write the directions for a pictorial drawing? Explain.
5. **Going Beyond.** Use walkie-talkies to give directions to another person instead of writing them or typing them. Was this method easier or harder? Explain.
6. **Going Beyond.** Use e-mail to send your instructions to a student in another school. Also have another student in another school send instructions to you. Exchange the resulting drawings by e-mail or fax machine.

Electronic Communication

SECTION 4

THINGS TO EXPLORE

- Identify electronic communication systems you use.
- Explain how electronic communication systems work.
- Tell what GPS is and how it is used.
- Use a GPS to set up a satellite dish.

TechnoTerms

communication satellite
electronic communication system
fax (facsimile) machine
fiber-optic system
geosynchronous
global positioning system (GPS)
modem

Did you talk long distance today to anyone? Or did you watch a news program live from another country by satellite? Communication technology has changed rapidly because of improvements in electronics. Today you use many **electronic communication systems**, such as radios, televisions, telephones, modems, satellites, and fax machines. These systems all use electronic or electromagnetic signals to carry messages through cables or through the air. In this chapter we will explore fiber optics, telephones, modems, fax machines, satellite communications, and global positioning systems (GPS). Chapter 16 will cover radio and television.

INFOLINK

See Chapter 16 for information about radio and TV.

Fiber Optics

Fiber-optic systems use light to carry information. What's so special about fiber optics? For one thing, fiber-optic cables are smaller, weigh less, and cost less than the many copper wires used on long telephone routes.

A *fiber-optic cable* is made out of many thin strands of glass fibers. Fig. 15-9. These fibers are sometimes thinner than a strand of your hair! This cable can carry light for long distances without loss of power. A strong light source such as a laser or a *light-emitting diode* (LED) is the transmitter. The fiber-optic cable carries the information that is received by a device that converts light energy into electricity. The cable can carry over 1000 circuits at a time.

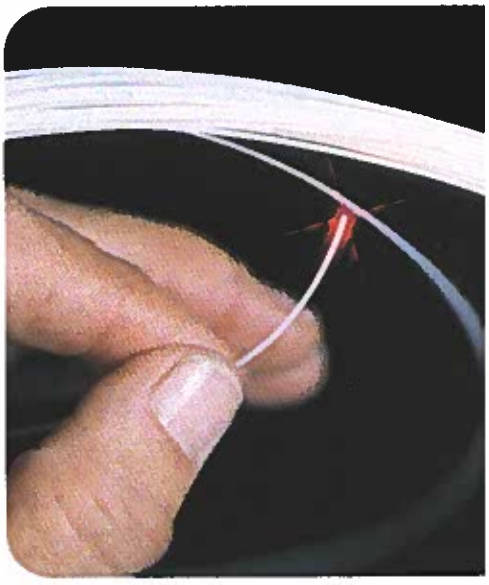


Fig. 15-9. Fiber-optic cables can carry many more messages than copper wire. Look up the meaning of the word optic. Share your findings with the class.

Fig. 15-10. How telephones have changed! What do you think the crank on the side of the old-fashioned phone is used for?

Telephones

What would you do without a telephone? Alexander Graham Bell never knew that his invention would end up being one of the most used electronic communication tools today. Fig. 15-10.

The telephone's mouthpiece changes sound into electrical signals. The ear piece changes the electrical signals back into sound. Since many telephone conversations take place at the same time, switches and lots of wires have to connect one town to another. Today, conversations are being carried over fiber-optic cables. This is because one pair of fiber-optic cables can carry over 1,000 conversations at one time!

TechnoFact

FASTER, FASTER!
Fiber optics really speeds up how fast computers can communicate with each other using modems. Using fiber optics can increase the speed by a multiple of 41,667!

Cordless telephones contain a small radio transmitter that sends a radio signal to the base of the telephone. The base is connected by wire to the telephone lines. *Cellular phones* also send radio signals. But cellular phones can transmit over an entire city, where cordless phones work only over short distances. Telephones are also connected to computers. In some places, you don't have to look up a number in a telephone book anymore! The computer does it for you.

Modems

You learned about modems in Chapter 4. It is important to understand that a **modem** changes computer signals into audio tones so they can travel over telephone lines. At the other end of the line, another modem turns the audio tones back into computer signals.

INFOLINK

See Chapter 4 for more information about modems.

Fax (Facsimile) Machines

Did you know that since the 1920s, weather maps have been sent by fax? **Fax (facsimile) machines** quickly send graphics or pictures electronically. An optical scanner moves across a page and changes information into electrical impulses. These impulses are sent over telephone lines to another location and then changed back into a picture. Corporations and businesses use fax communication to order materials and to send letters.

Satellite Communication

You now have instant access to any part of the world by means of satellites. **Communication satellites** are relay stations for television and radio. Have you ever heard of the Clarke Belt? It is an area 22,300 miles over the Earth's equator where many communication satellites are orbiting. Their orbits are **geosynchronous**, which means they stay in the same place above the Earth at all times. Fig. 15-11. They travel at the same speed as the Earth turns, so it appears as if they are fixed, or *geostationary*.

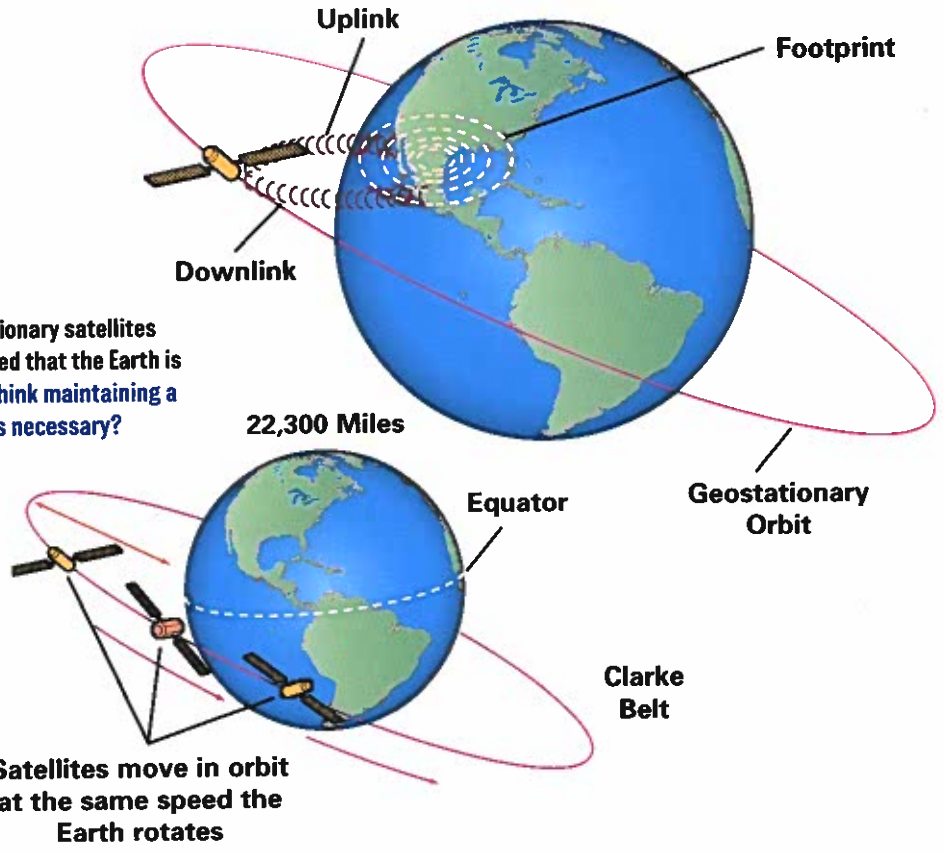


Fig. 15-11. Geostationary satellites orbit at the same speed that the Earth is turning. Why do you think maintaining a satellite in one spot is necessary?

Satellite signals are *microwave signals*. Antennas on board each satellite focus the microwaves onto a special place on the Earth's surface. The microwaves travel in a straight line because the satellite remains in the same spot above the Earth. Signals going from the Earth to the satellite also follow a straight path.

A transmitting station sends a transmission on one frequency, called the *uplink*, to the satellite. Inside the satellite, a receiver takes in the signal and changes it to another frequency called the *downlink*. The area over which signals can be picked up is called the *footprint*. Satellite footprints show where each satellite's power levels are the best. If you have a satellite receiver, you can pick up transmissions. Some commercial uplink sites scramble their transmissions so people cannot receive them for free.

TechnoFact

LOST AND FOUND

Like the Internet, the global positioning system started with the military. The U.S. Air Force, along with the other armed forces, developed a navigation system called *Navstar*, which eventually became GPS. Today, anyone can buy a GPS receiver and use it to find his or her position anywhere on Earth.

The Global Positioning System (GPS)

Imagine an electronic device that could tell you your location anywhere on Earth in latitude, longitude, and even altitude. What if that same device could map your travel path and guide you to your desired location or bring you back to where you started?

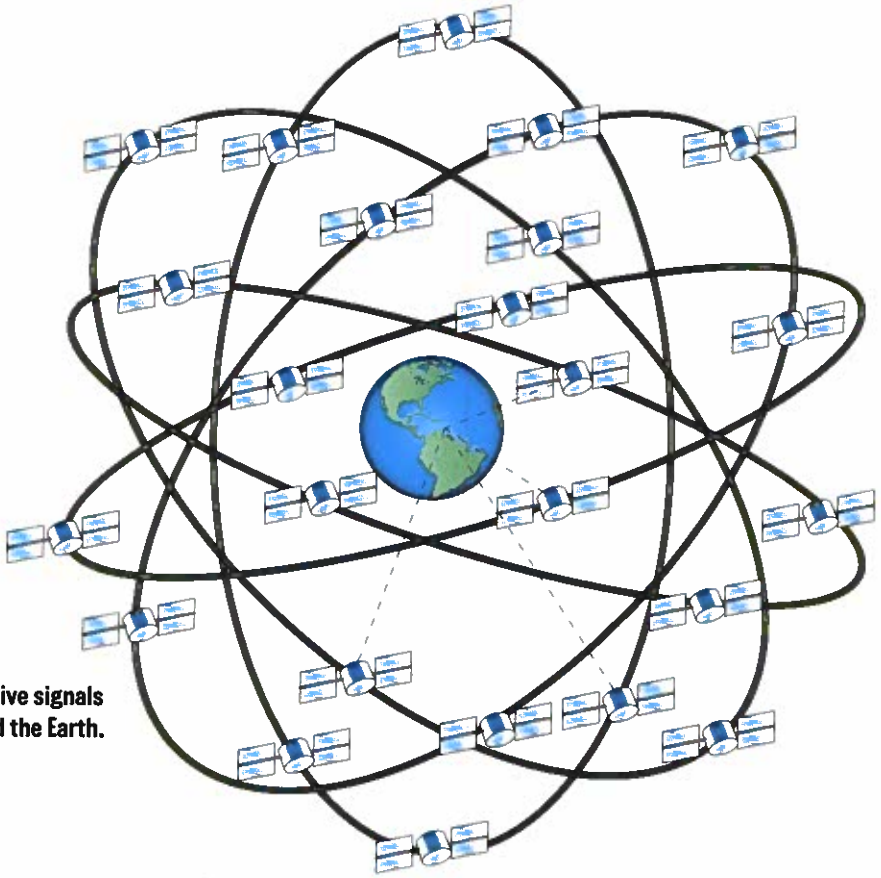


Fig. 15-12. GPS receivers receive signals from 24 satellites in orbit around the Earth.

Now imagine such a device being small enough to fit into your pocket or even be a part of your wristwatch. That incredible technology exists today, and it's called the **global positioning system (GPS)**. Fig. 15-12.

The handheld electronic devices are actually called *GPS receivers*. They receive signals sent from 24 GPS satellites in orbit around the Earth. Each of the satellites has a very accurate atomic clock on board. GPS receivers use this accurate time signal to calculate positions and travel paths.

The longitude and latitude of a location are its *coordinates*. GPS receivers can store dozens of specific coordinates for many locations. Each location is called a *waypoint*. Waypoints are points along a path or route that help the GPS receiver keep track of your exact movement.

You don't have to be sitting still to use GPS signals. Airplanes use GPS to find their location and locate airports. GPS is even available in some cars to help find the best route and prevent drivers from getting lost. Many people can enjoy the accurate navigation ability of GPS while hiking, fishing, or boating. Law enforcement officials use GPS for search and rescue operations. Geologists and forestry workers use GPS to locate and map specific sites.

The future of communication depends a lot on what you as the consumer need and expect from it. Who knows? Maybe you'll be able to turn your own room at home into a live TV studio using the telephone lines and a video camera. Won't it be fun to send a "live" greeting to a friend somewhere far away?

TechnoFact

PLAY IT SAFE **In just a few years, GPS receivers have increased in capabilities and decreased in cost. As GPS technology gets even smaller and cheaper, more people may use it. However, the directions that come with GPS receivers warn users not to rely on them for all their navigation needs. If you are thinking of a trip that requires navigation skill, take a compass and a map in addition to a GPS device. The batteries might go dead just when you need them!**

SECTION 4 TechCheck

1. What electronic devices do you use to communicate?
2. How do electronic communication devices work?
3. What is GPS and how is it used?
4. **Apply Your Knowledge.** Use a GPS device to track your path as you walk around the perimeter of your school.

SECTION 4

ACTION ACTIVITY

Where in the World Are You?

Be sure to fill out your TechNotes and place them in your portfolio.

Real World Connection

GPS satellites and direct-TV satellites are in a geostationary orbit above the Earth. If you combine the two technologies, you can learn about how both GPS and direct-TV broadcasting work.

Design Brief

Use a GPS device to find your location, Use the coordinates of your location to aim a direct-TV satellite dish and receive a TV signal. Fig. A.

Materials/Equipment

- GPS receiver
- compass
- level
- direct-TV satellite dish (18" or smaller)
- satellite receiver
- television or monitor

SAFETY FIRST

- **Check with your teacher to see where you should locate the satellite dish. You will be setting up the dish for only a short time.**
- **There is no need to go up on a roof or mount the dish permanently.**
- **Do not attempt to do this activity in the rain or if there are storms in the area.**
- **If necessary, use only approved extension cords.**
- **Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.**

Fig. A

Procedure

1. Ask your teacher where you should locate the satellite dish. Work with a partner.
2. Set up the mounting post of the satellite dish so it is plumb (straight up and down). Use a level to check it.
3. Use a GPS receiver to determine the latitude and longitude of your location. Fig. B. Write the coordinates on your TechNotes.
4. Turn on the satellite receiver and go to the setup menu. Choose the option of using latitude and longitude.
5. Enter your coordinates. The receiver will display the elevation and azimuth for your location. The azimuth is the direction measured in degrees from north. The elevation is the angle of the satellite dish measured in degrees.
6. Adjust the angle of the dish to the proper *elevation*. Use the compass to point the dish in the direction given in the *azimuth*.
7. Set the satellite receiver using its signal strength meter. Make small adjustments in the dish until a strong signal is received.
8. Set the satellite receiver to the free preview channel and show your teacher that you have been successful.

Evaluation

1. List three uses for a GPS receiver.
2. How is it possible to adjust a direct-TV satellite and not need to change its position to continue receiving a signal?
3. What is azimuth and how is it measured?
4. **Going Beyond.** With your teacher's help, take the GPS device on a field trip. Check its accuracy on the return trip.
5. **Going Beyond.** Research where direct-satellite broadcasting originates.

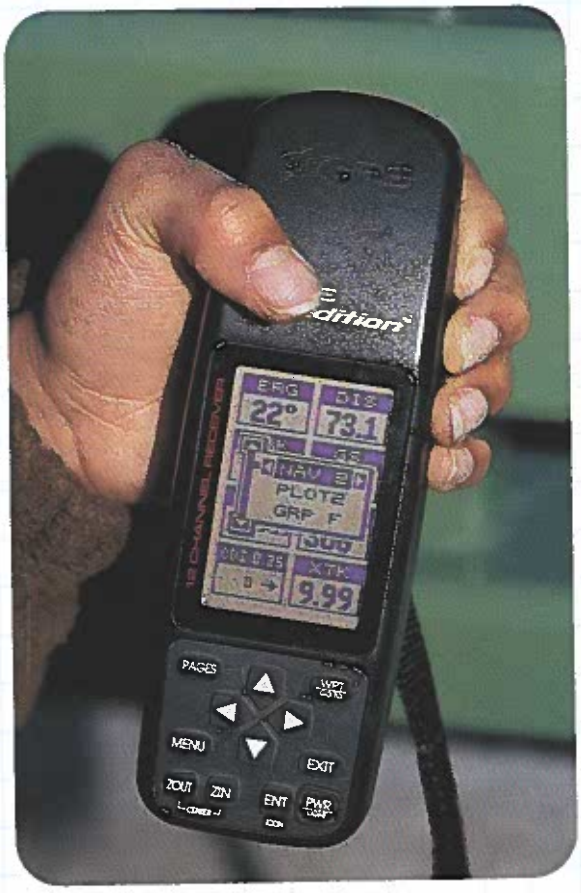


Fig. B

CHAPTER 15

REVIEW &

CHAPTER SUMMARY

SECTION 1

- Communication is the process of exchanging information.
- A communication system has input, output, process, feedback, and interference.

SECTION 2

- Networks are groups of computers linked together.
- The Internet consists of millions of computers linked together.

SECTION 3

- Technical writers write instructions or manuals.
- Technical illustrators show objects in either pictorial drawings or orthographic drawings.
- Computers allow technical designers to create very precise drawings that are easy to edit.

SECTION 4

- Electronic communication systems such as radio, television, telephone, fiber optics, modems, satellites, and fax machines are used today.
- Satellites in geosynchronous orbit stay in the same place above the Earth at all times.
- GPS technology can be used to find your location anywhere on Earth.

REVIEW QUESTIONS

1. How does today's instant communication, such as a live television news broadcast, make our world seem smaller?
2. What is an Internet browser?
3. What two electronic communication devices do you use most at home?
4. Why is it difficult to write a technical manual?
5. How might people use a GPS receiver?

CRITICAL THINKING

1. What are some positive and negative effects on society of today's communication technology?
2. Research ways to make a poster using a computer and a digital camera. Does your school have the technology to do this yet? How could you use this process to make photographs for your school newspaper?
3. Send a set of written directions for drawing an object or making a product to students in a foreign country. Get a set of directions from a foreign student. Use a translation dictionary to understand the instructions. Exchange the drawings through the mail. Were there more errors in understanding the instructions when you had to translate the language? Why?