

# ACTIVITIES 15

## CROSS-CURRICULAR EXTENSIONS

- 1. COMMUNICATION** With your teacher's help, design a website for your school. Ask other teachers to have their students make web pages for each subject.
- 2. SCIENCE** Research how to make a hologram and try to make one.
- 3. MATHEMATICS** Research how microwaves and other electromagnetic radiation are measured.

## EXPLORING CAREERS

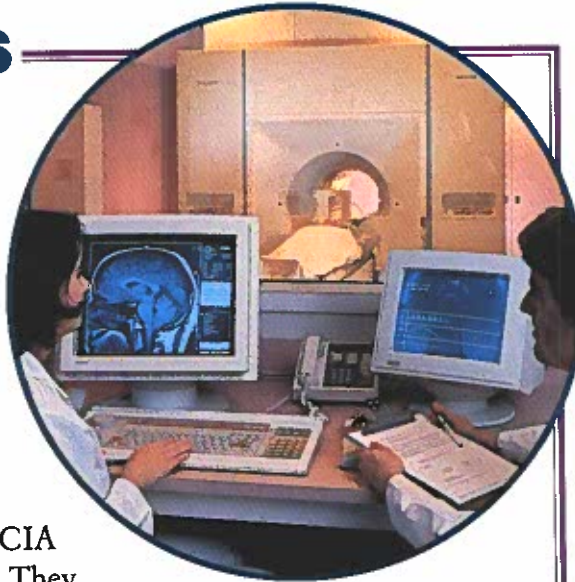
When your parents were in school they had to go to the library to look up information. Today we are expanding our ability to create, find, and use information. Careers like those listed below involve the search for information.

### Central Intelligence Agency

**Engineer** The CIA employs engineers to develop technology for collecting and analyzing information. This involves both in-house development and working with private companies to acquire technology that has already been developed. CIA engineers must be interested in the latest technology. They also must have good communication skills.

### Medical Research Technician

Techniques used in medical research today were found only in science fiction 20 years ago. Medical research technicians can be involved in many different tasks and may work on projects as part of a team. Most technicians conduct several experiments at the same time. Medical research technicians must keep accurate records.



## ACTIVITY

Suppose you have just been offered a new job. Write down all the questions that you think you should ask before deciding whether or not to accept the position.

# Producing TV/Radio Programs

**SECTION****1** How Radio and TV Work**2** Pre-Production

ACTION ACTIVITY **Writing a Script and Rehearsing a Program**

**3** Radio Broadcasting

ACTION ACTIVITY **Broadcasting a Radio Program**

**4** Video Production

ACTION ACTIVITY **Producing a Video**



# How Radio and TV Work

## SECTION 1

### THINGS TO EXPLORE

- Describe the early days of radio and television.
- Explain how radio signals are sent and received.
- Explain how a television changes signals into audio and video information.
- Give examples of how television and radio impact your life.

### TechnoTerm

audio  
frequency  
hertz  
video

You have enjoyed TV and radio programs, but how often have you really thought about all the work that goes into making them? How different would your life be without TV or radio? Let's take a quick look at the history and technology behind TV and radio.

## Radio

In 1901, Guglielmo Marconi became the first person to transmit and receive wireless signals across the Atlantic Ocean. Right away, people could see how radio communication was going to help them. Fig. 16-1.

Do you ever turn on the radio to listen to music or hear the latest news or the weather report? Have you ever picked up a station hundreds of miles away while riding in a car?

**OPPOSITE** Much goes on behind the scenes before your favorite TV programs can be broadcast.



**Fig. 16-1.** When these operators see something important on their radar screens, they radio the information to other locations in the submarine. Why do you think radios are used? Why don't people simply deliver the information in person?

## TechnoFact

### PERSONAL RADIOS

Today's communication technology even lets you have a conversation using pocket-sized portable radios. The Family Radio Service, or FRS, frequencies have been set up for inexpensive hand-held radios.

In radio broadcasting, information is sent through the air by means of transmitters to a receiving antenna someplace else. The messages travel at a certain **frequency**, which is measured in cycles per second. One cycle per second is called one **hertz**. Each radio station transmitter uses a different frequency, and there are many frequencies to choose from. Transmission happens very fast. Radio waves travel at about 186,000 miles per second, no matter what the frequency!

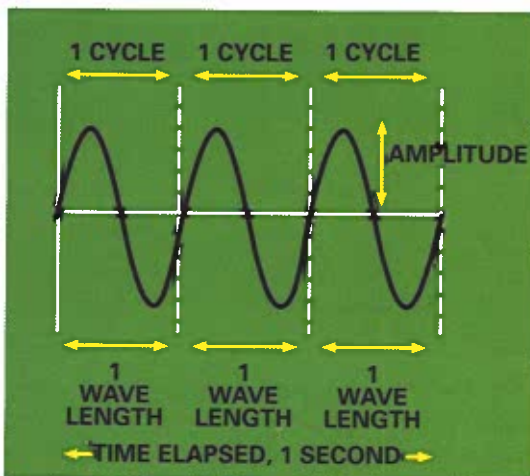
## Television

Americans were first introduced to TV in a futuristic exhibit at the 1939 World's Fair. The first successful TV transmission was made by John L. Baird. Inventors Philo Farnsworth and Vladimir Zworykin came up with a combination of technologies that led to the TV we know today.

Did you know we watch an average of three hours of television every day? Television is used to inform, entertain, and sell. Many shows bring subjects like history and science alive. While you're watching, you also become one of millions of possible consumers for the products advertised during the shows. You can even shop at home by calling a toll-free phone number and using a credit card to order hundreds of products.

## COMMUNICATION CONNECTION

### Waves That Carry Information

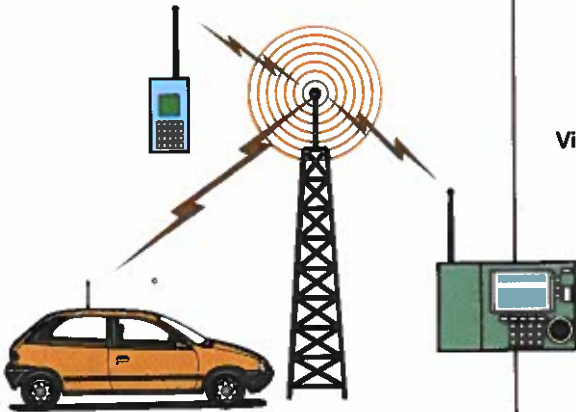


Energy can travel in waves that are both electrical and magnetic. The waves can differ in frequency and length, but they all travel at the same speed. This range of waves is called the electromagnetic spectrum.

Hz = hertz  
 kHz = kilohertz  
 MHz = megahertz  
 GHz = gigahertz  
 THz = terahertz

## THE ELECTROMAGNETIC SPECTRUM

Radio waves are broadcast from radio stations and received by radios in cars and homes. Radio, TV, and light each occupy a different frequency in the electromagnetic spectrum (see the chart at right).



| TYPICAL USE                   | WAVELENGTH      | FREQUENCY         |
|-------------------------------|-----------------|-------------------|
| House Current                 | 3 million m     | 100 Hz            |
| Stereo Tape Player Range      | 300 km          | 1,000 Hz=1kHz     |
|                               | 30 km           | 10 kHz            |
| AM Radio                      | 3 km            | 100 kHz           |
|                               | 300 m           | 1,000 kHz=1MHz    |
| Short Wave Radio              | 30 m            | 10 MHz            |
| FM Radio, TV                  | 3 m             | 100 MHz           |
| Car Telephones                | 30 cm           | 1,000 MHz=1GHz    |
| Police Radar Microwave Radios | 3 cm            | 10 GHz            |
|                               | 3 mm            | 100 GHz           |
| Infrared                      | 300 microns     | 1,000 GHz=1THz    |
|                               | 30 microns      | 10 THz            |
|                               | 3 microns       | 100 THz           |
| Visible Light                 | 3,000 angstroms | 1,000 THz         |
| Ultraviolet                   | 300 angstroms   | 10,000 THz        |
|                               | 30 angstroms    | 100,000 THz       |
| X Rays                        | 3 angstroms     | 1,000,000 THz     |
|                               | 0.3 angstroms   | 10,000,000 THz    |
| Gamma Rays                    | .03 angstroms   | 100,000,000 THz   |
|                               | .003 angstroms  | 1,000,000,000 THz |

All waves have amplitude and frequency. Amplitude is the amount of energy the wave carries. Frequency is the number of waves that pass a given point in one second. Shorter waves have a higher frequency than longer waves.

Frequency is measured in cycles per second, or hertz. The waves shown in the drawing have a frequency of 3 hertz.

Electromagnetic waves can be used to carry radio, TV, and other signals, as shown in the diagram above.

## ACTIVITY

Scan all the frequencies on an AM or FM radio. Find how many stations you can pick up in your area and where they are all located in the electromagnetic spectrum.





**Fig. 16-2.** An antenna receives a TV signal and transmits it through wires to the receiver inside the house.

Television communication changes **audio** (things you can hear) and **video** (things you can see) information into electrical signals. The signals are sent out and then changed back into pictures and sound by your TV receiver. Fig. 16-2. The signals might be sent to your home by cable, broadcast directly from a transmitter, or bounced off a satellite.

A monitor is like a TV without the ability to change channels. Many TV's today are really a TV and a monitor together.

Combination cameras and recorders called camcorders are often used to record video and audio onto tape. At home, you can watch the videotape or record over it on a video cassette recorder (VCR).

## SECTION 1

### TechCHECK

1. When was the first wireless radio message sent and received?
2. How are radio and TV signals sent and received?
3. How are electrical signals for television changed back into sounds and pictures?
4. **Apply Your Knowledge.** Make a poster showing how television or radio works.

### THINGS TO EXPLORE

- Explain what pre-production is and list some of the planning steps.
- Tell why it is important to have good talent and a good script.
- Write a script and rehearse a show.

### TechnoTerm

ad lib  
pre-production  
public service  
announcements  
(PSA)  
talent

**D**id you know that many hours of planning and rehearsing are required for every minute of TV that we watch and radio that we hear? This work is called **pre-production**. Pre-production has a direct effect on the quality of the finished show. It might include

- script writing
- drawing storyboards
- making cue cards or programming a teleprompter
- rehearsal

## The Talent

The people at the microphone or in front of the camera are generally called the **talent**. What would happen if the talent had no idea of what to say or do? Some creative performers can easily work without a script. They **ad lib**, or make up, what they say and do. However, most of what we watch on TV and listen to on the radio has been planned in great detail in a script. The plan is then practiced in a test run called a rehearsal.

Dialogue is sometimes written with large letters on big sheets of paper called *cue cards*. The talent can read the words at a distance in case they forget their lines. A *teleprompter* is a computer used to display the dialogue on a sheet of glass in front of a camera. Fig. 16-3. The talent can read the dialogue, but it doesn't show on camera.



**Fig. 16-3.** This student is practicing with a teleprompter. The dialogue is entered into the computer and printed out on the screen for the talent to read. **Why do you think TV directors use hand signals while a program is being taped?**

## Writing for TV and Radio

Good talent can help make a show interesting. However, watching TV or listening to the radio would be pretty dull if the shows didn't have a story line or a theme. Careful script writing can keep viewers' or listeners' attention.

A script includes written words, called *dialogue*, and other details necessary to stage the program. Fig. 16-4. Radio scripts might include dialogue for the news, commercials, and music segments. Special announcements that warn people of the dangers of smoking or remind them to wear seatbelts are called **public service announcements (PSAs)**. TV scripts include special instructions for camera operators, lighting technicians, special effects, and set design. The set is the stage area that can be designed to look like anything from a living room to a space station.

Fig. 16-5 shows a storyboard. A *storyboard* is a simple cartoon drawing showing the main "scenes" in a video.

In the activity for this section, you will write a script and rehearse it as part of pre-production. All of the pre-production steps are important to make sure your production is a good one.

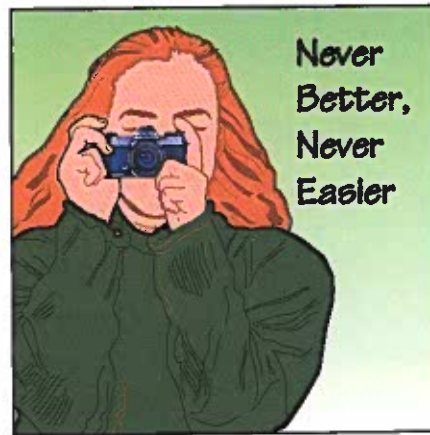
**TechnoFact**

**STAY TUNED** A good script holds the audience's attention, but some scripts do their job *too well*. In 1938 a radio broadcast of the science fiction story *War of the Worlds* was done so realistically that many people believed Earth had actually been invaded by Martians!

| SAMPLE SCRIPT |                                     |  |                                      |
|---------------|-------------------------------------|--|--------------------------------------|
| CAMERA        | SUBJECT                             | DIALOGUE                                     | SPECIAL EFFECTS                      |
| CLOSE-UP      | YOLANDA SITTING AT ANNOUNCER'S DESK | YOLANDA: NOW LET'S GO TO OUR WEATHER REPORT. | VFX: DISSOLVE TO TIM AT WEATHER DESK |

**Fig. 16-4.** VFX is short for *video effects*. What camera movements and special effects would you use in a short video on how to feed a dog or other pet?





**Fig. 16-5.** Storyboards do not usually show much detail. How do you think having a storyboard would help a TV director?

## SECTION 2

### TechCHECK

1. What are the possible steps in pre-production?
2. What is talent?
3. Why are good talent and a script important to a production?
4. **Apply Your Knowledge.** Ask your local radio station broadcasters if they follow scripts or ad lib most of the time.

**Writing a Script and Rehearsing a Program**

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

**Real World Connection**

Have you ever watched an educational program on TV or heard one on the radio? TV and radio can teach us many things. In this activity, you will be the script writer, talent, and part of a TV or radio pre-production team to produce your own program. Fig. A. The program will be completed in later activities. Your finished program will be shared with other classes to teach them something you have learned about technology.

**Design Brief**

Write a script and rehearse a video or radio program (or both) that is informative as well as entertaining. Your program should teach the audience about some aspect of technology and run from five to ten minutes. Your program should include a commercial for a product or a public service announcement.

**Materials/Equipment**

- props, studio lights, costumes (as needed)
- camcorder or audio recorder
- stereo, tape deck, CD player, mixer, microphone (optional)

**SAFETY FIRST**

- Keep away from hot studio lights. Watch where you walk to avoid tripping on mic (microphone) cords or video cables.
- Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.

## Procedure

1. Work in a group of three to five people to plan your program. In a later activity, your group will team up with another group for the actual production. While your group is performing in front of the camera, the other group will be operating the equipment. When your group is finished, you will switch places.
2. Brainstorm ideas that you could use for your program. Remember it must be both instructional and entertaining. Here are some possible topics and themes.
  - The fast growth of technology
  - How technology has affected our world
  - Making a pneumatic robot arm
  - A technology quiz or game show
  - A news program or soap opera
  - A how-to program
3. Write a script for your idea. Everyone in your group should have a part. Ask your teacher to approve any special props, music, or costumes that you think you might use in your production.
4. Be sure to include a commercial for a product or a public service announcement. Many commercials run for 1 minute. Some are 30 seconds or up to 2 minutes long. Design your commercial to fit one of these times. The commercial message can also be educational.
5. Use stereo equipment to record your audio or video commercial.
6. Rehearse your program and refine your presentation for the next activities. Time the length of your production.

## Evaluation

1. List items that might be included in a script.
2. Why do you think commercials should be short?
3. Name some occupations related to TV and radio production.
4. **Going Beyond.** Team up with a language arts and drama class to write and produce your production.
5. **Going Beyond.** Design and build a set to simulate a scene from a movie you have seen. Use the set in your video production.
6. **Going Beyond.** Record sound effects while recording a story on audiotape. Try to make realistic sounds related to your story, such as doors slamming, people walking, or horses galloping.

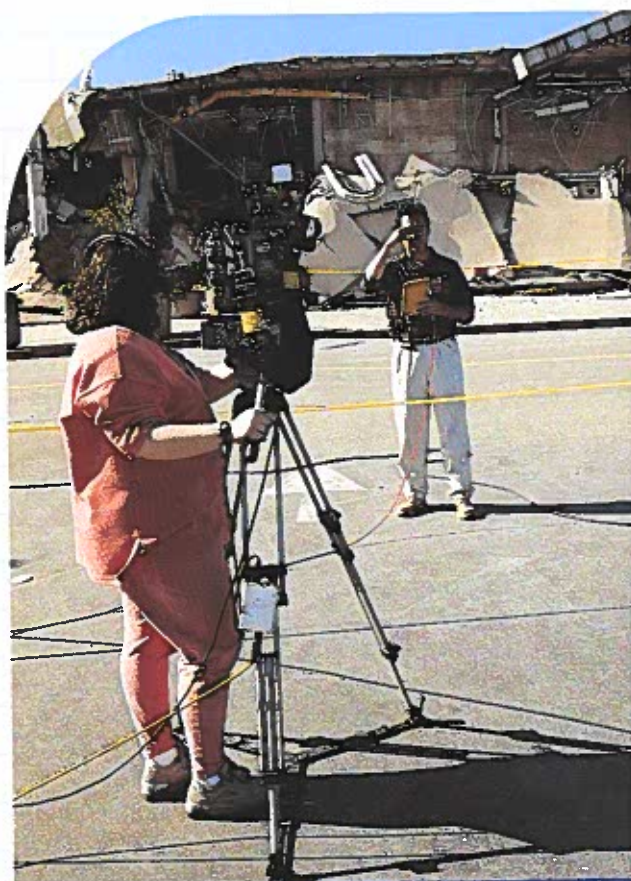


Fig. A



**TechnoTerm**

amplitude modulation (AM)

dead air

frequency modulation (FM)

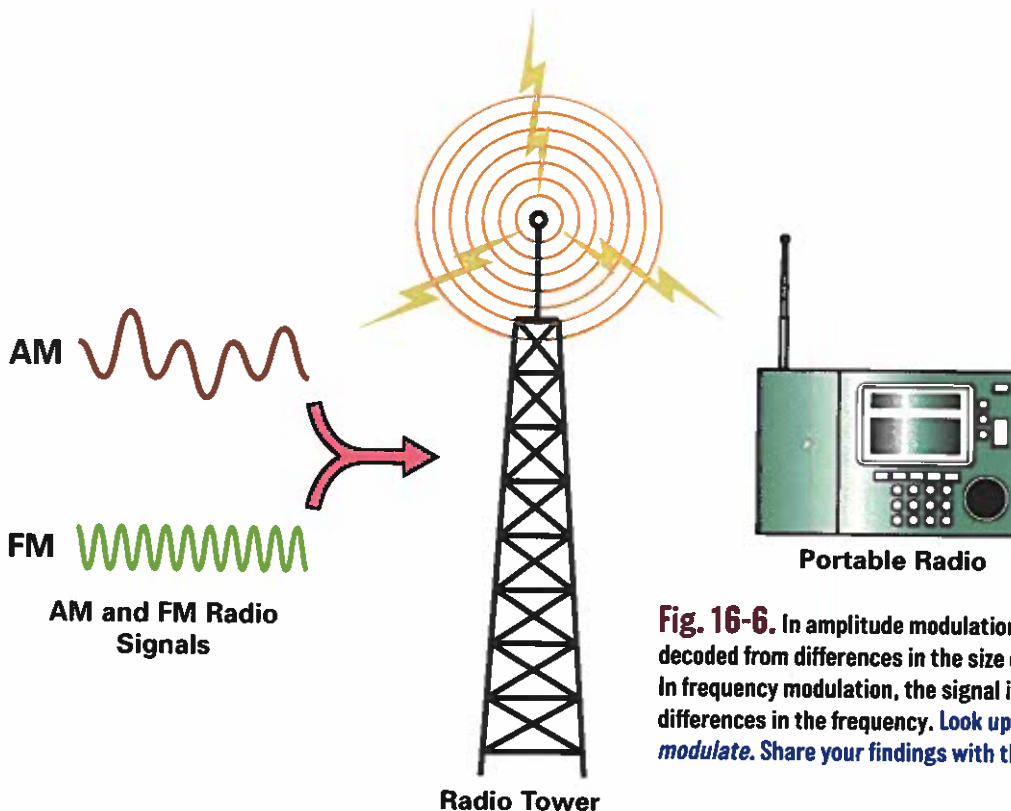
silence sensors

**THINGS TO EXPLORE**

- Tell what AM and FM radio frequencies are.
- List the parts of a radio program.
- Describe common jobs in radio broadcasting.
- Broadcast a radio program.

The radio stations we listen to differ in how the radio signals are sent and received. AM stands for **amplitude modulation**. FM means **frequency modulation**.

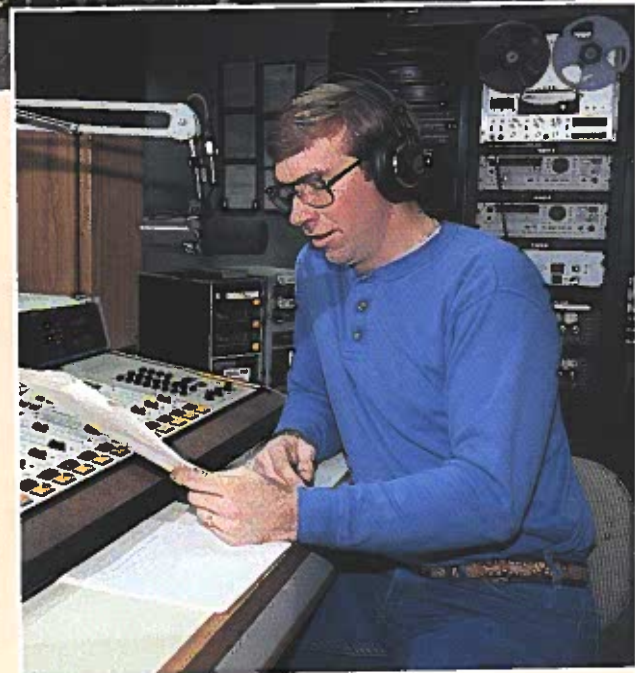
Fig. 16-6. Both types of stations usually specialize in one style, or format, of programming such as classical, jazz, rock, or country music. No matter what type of format is used, workers such as announcers, combo operators, engineers, or radio personalities, are needed. Fig. 16-7.



**Fig. 16-6.** In amplitude modulation, the signal is decoded from differences in the size of the radio wave. In frequency modulation, the signal is decoded from differences in the frequency. Look up the meaning of *modulate*. Share your findings with the class.

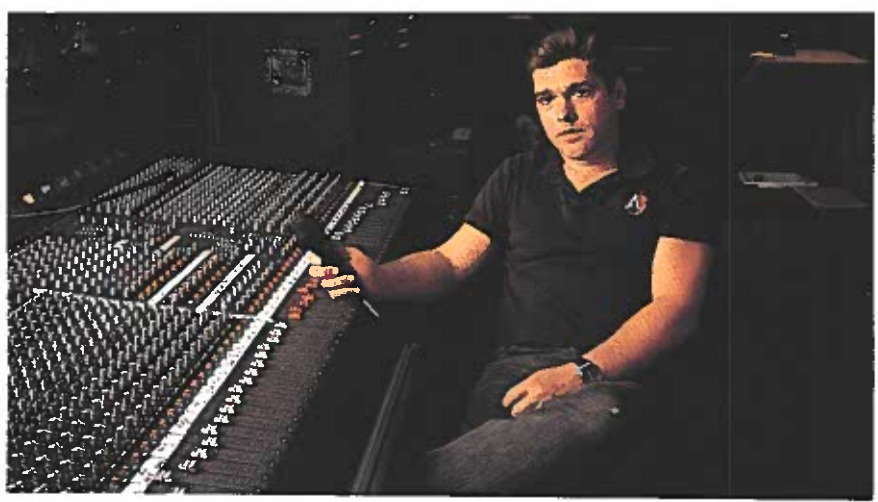


**Fig. 16-7.** An announcer (top left) reads the news. A combo operator (bottom left) is an announcer as well as the operator of equipment. Engineers (middle) operate control room equipment. Radio entertainers (bottom right) usually have colorful personalities.





One job that audio engineers do is to operate the audio mixer.



## TechnoFact

**ALL MIXED UP** Audio mixers let you combine several audio sources into one signal. For example, a recording of people talking can be mixed with recorded music. The photo shows an audio mixer.

A radio program is made up of parts that usually come at a special time. Some of these include station identification, introduction, music, weather, sports, and news. Listeners become used to the schedule and know when to tune in.

Radio stations must stay on a strict time schedule because some of the programming, like the news, comes from a “live,” rather than a pre-recorded, source. Live news is often sent to many radio stations at the same time using a satellite signal. Professional announcers try to avoid cutting off a song in the middle to play the news.

Have your ever been listening to a radio program and noticed silence for a short time? This is called **dead air**. Dead air is usually caused by equipment problems or by someone not flipping a switch at the right moment. Radio professionals try to avoid it. If listeners don't hear anything for even a short time, they often change the station. **Silence sensors** are electronic devices that detect silence and automatically trigger a different audio source, such as a recording of music.

### SECTION 3

## TechCHECK

1. What are two types of signals used for radio? What is the difference between them?
2. List parts of a radio program that usually happen at a certain time.
3. What are some occupations related to radio production ?
4. **Apply Your Knowledge.** Use an audio recorder to record a simulated radio broadcast of a school sports activity. Play the tape for the class.



## Broadcasting a Radio Program

### Real World Connection

Today, we often listen to the radio for music, news, weather, and sports. If you chose to write an audio script earlier, in this activity you will use a school radio station to record and transmit your audio program.

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

### Design Brief

Record or transmit a five- to ten-minute radio broadcast. Include a commercial or public service announcement. Identify yourself and give credit to the production staff.

### Materials/Equipment

- CD player
- audio tape recorder
- mixer
- microphones
- stereo amplifier/speakers
- headphones
- FM transmitter (optional)

#### SAFETY FIRST

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



(Continued on next page)

**ACTION  
ACTIVITY****Procedure**

1. Work in groups of two to four. Do not play inappropriate songs or use offensive language. Ask your teacher to pre-approve your script and the lyrics (words) to songs. Read through your approved script and time how long it takes.
2. Your teacher will demonstrate how to use the audio equipment. Fig. A. Practice recording and using the mixer and microphones (mics). Use the audio mixer to combine your voice and music.
3. Set the stereo speakers so the entire class can hear your broadcast. Turn off the speakers in the room in which you are broadcasting or the mics will pick up the sound from the speakers and make a loud hum called *feedback*.
4. Record your broadcast on audio tape so you can listen to yourself later.

**Evaluation**

1. What is feedback?
2. How can you prevent feedback?
3. What do you think would happen in a real broadcast if there was dead air for a long time?
4. What does an audio mixer do?
5. **Going Beyond.** Visit a radio station to see how professionals broadcast.
6. **Going Beyond.** Ask if it would be possible to set up a real radio station at your school.
7. **Going Beyond.** Research digital radio on the Internet. With help from your teacher, listen to Internet radio from other countries. Research the future of digital radio.

**Fig. A**

# Video Production

## THINGS TO EXPLORE

- Describe in-camera, linear, and non-linear editing.
- Describe the difference between first- and second-generation video copies.
- Produce a TV program.

**TechnoTerm**  
character generator  
in-camera editing  
linear editing  
non-linear editing

You probably will be surprised at how much planning and rehearsing it takes to make a professional-looking TV show. Even with the best script writing and many rehearsals, all TV programs require changes. The process of making changes is called editing.

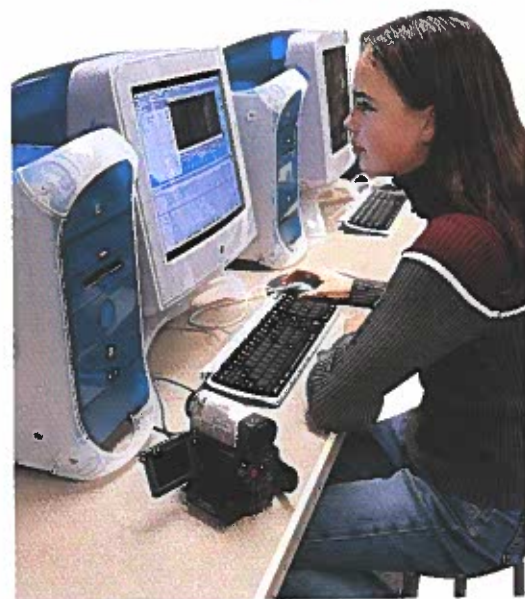
## Kinds of Video Editing

The simplest way to produce a video program is to plan each shot in sequence and tape them in order. This process is called **in-camera editing**, but it is not always the best method to use. As your productions become more complex, in-camera editing will no longer be possible. The quality of your final program may depend on how well it is edited.

During **linear editing**, segments from two or more tapes are combined into a finished program. The original (first generation) tape must be fast-forwarded or rewound until the right segment is found. Next, the segment is copied onto another tape (second generation). Each time the material is copied, some of its quality is lost. By the time a third generation tape is made, its quality is often unacceptable.

Today's digital video camcorders store information in digital form. Editing is done by plugging the digital camcorder directly into a computer. Fig. 16-8. "Clips" (segments) are digitized and stored on the computer's hard drive. A simple point and click method is then used to arrange the clips in the proper sequence.

**Fig. 16-8.** The camcorder on the table can be plugged directly into the computer, and the tape is edited on-screen. Tape a 30-second commercial you see on TV and analyze it. How many "cuts" (jumps) from scene to scene does it contain?





## TechnoFact

### MAKING COPIES

Duplicating video tapes is called **dubbing**. It is easy to do with two VCRs.

Each wire goes from the **OUT** connector on one VCR to the **IN** connector of the other.

Because the clips are digitized, special effects are easy to add as well. Since you can use the computer to jump to whatever part of the video you want to without waiting for the tape to forward or rewind, digital video editing is called **non-linear editing**.

Editing video is like editing a written story. In writing, it is often necessary to move sentences or paragraphs. Using word-processing software makes the process of editing your writing easier. Using non-linear video editing software does the same thing for video, making desktop video production possible.

## Video Titles and Text

The beginning title or the credits at the end of a program can add a professional look to your production. The text you see on TV is created by a special computer program called a **character generator**. Technicians type in the required words before air time. The text can appear unmoving on the screen, it can crawl sideways, or it can scroll up or down.

## TechnoFact

### TOO CLOSE TO THE

**EDGE!** When making text for TV, technicians must be careful not to type too close to the edges of the screen. The 80 percent of the screen used for text is called the *safe graphics area*.

## Putting It All Together

The actual production of a TV program is an exciting thing to watch. In addition to the talent getting their lines correct, all of the equipment must work just right. Live broadcasts are especially interesting because the show must go on no matter what. For example, take a close look at the tiny lapel microphones that newscasters wear clipped to their clothing. Notice that they often wear two mics together. This is a safety measure in case one mic stops working while they are on the air. This way they can keep going and no one even knows there has been a problem.

## SECTION 4

### TechCHECK

1. How do first generation and second generation copies of a video differ?
2. Why is in-camera editing not always workable?
3. What is the difference between linear and non-linear editing?
4. **Apply Your Knowledge.** Tape an activity and practice in-camera editing as you tape.

## Producing a Video

### Real World Connection

Putting the whole show together takes lots of time and planning. In this activity, you will actually record the video your group planned in the first activity.

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

### Design Brief

Produce a five- to ten-minute video on a technology-related topic. Include at least one commercial or public service announcement. Fig A. Make the video look and sound as much like a real television program as possible. Show your completed video to the entire class.

### Materials/Equipment

- props, costumes (as needed)
- studio lights (as needed)
- camcorder, audio recorder
- audio and video tapes
- stereo, tape deck, CD player, mixer, microphone (optional)

#### SAFETY FIRST

- Keep away from hot studio lights.
- Watch where you walk to avoid tripping on cords or video cables.
- Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.



Fig. A

(Continued on next page)

# ACTION ACTIVITY

## Procedure

1. Your teacher will demonstrate the proper use of the video equipment (Fig. B) and the connectors needed (Fig. C).
2. Gather or make any props that you will need. Some things you might include are
  - graphic title for the introduction
  - graphic for audio commercial
  - credits for the actors, actresses, production staff, and so on
  - costumes or backgrounds to make your production look real
3. Rewind the tape you are using and set the counter on the camcorder or VCR to zero. This way you will be able to find your place on the tape.
4. Be careful not to record over another production. Write down the starting and finishing times, or index numbers, so that your production can be found easily to show to the entire class.

5. Make cue cards to help the talent remember their lines.
6. Tape your program. Fig. D. Keep a close eye on the picture and listen to the sound being recorded using headphones.
7. Show your finished program to the entire class.



Fig. C

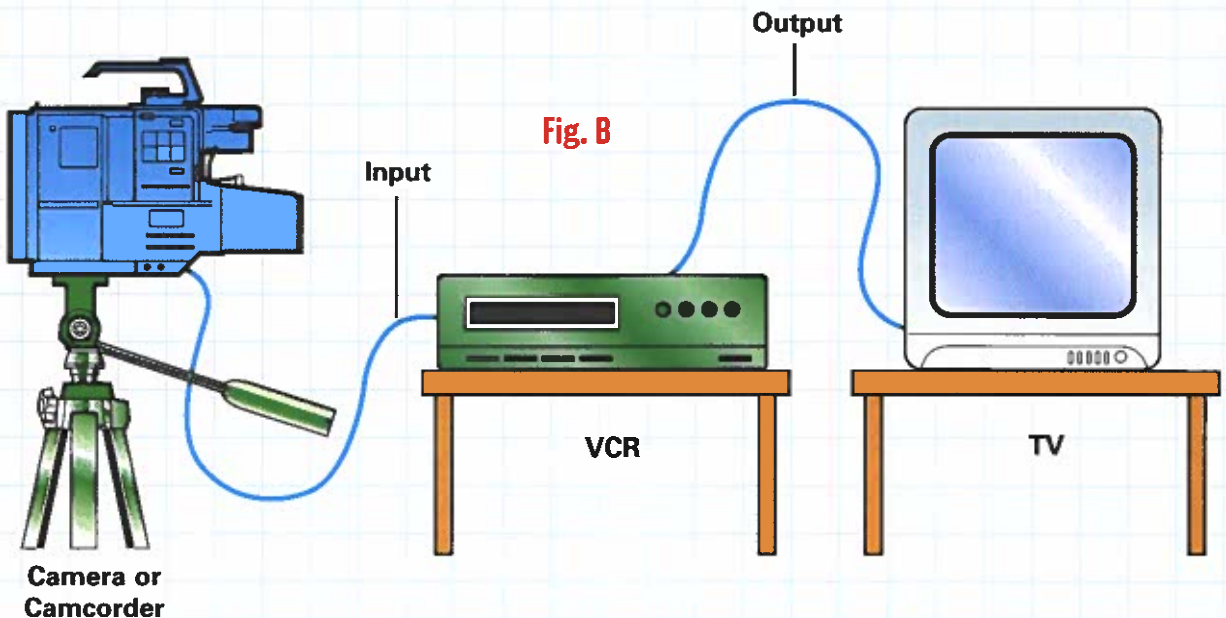


Fig. B



## Evaluation

1. Why do newscasters often wear two mics at the same time?
2. Why must everything work correctly the first time in live programs?
3. Why is it important to rewind tapes and zero the counter?
4. **Going Beyond.** Make a news video about other activities in the technology room.
5. **Going Beyond.** Ask your teacher if you could show your video to other classes. Find out if you could set up a studio in your technology room. See if you could produce a school news program that the entire school could watch every day.
6. **Going Beyond.** Check with your teacher about going on a field trip to a TV production studio in your area. Write a report or prepare a slide show that compares that studio with the studio in your technology classroom.



Fig. D

**CHAPTER SUMMARY****SECTION 1**

- In 1901, Guglielmo Marconi became the first person to transmit and receive a wireless message across the Atlantic.
- Radio stations have an assigned frequency measured in hertz.
- Philo Farnsworth and Vladimir Zworykin invented technologies that led to the TV we know today.

**SECTION 2**

- The work that goes into planning a TV or radio program is called pre-production and includes script writing, storyboards, and rehearsal.
- Careful script writing can help avoid production problems and keep the viewers' or listeners' attention.

**SECTION 3**

- The radio stations we listen to are either AM or FM.
- Some of the parts of a radio program might include station identification, introduction, music, weather, sports, and news.

**SECTION 4**

- The quality of a television program depends on how well it is edited.
- The text we see on TV is created by a special computer program called a character generator.

**REVIEW QUESTIONS**

1. Who was the first person to transmit and receive a wireless message?
2. Why is it important to rehearse a script?
3. What is the simplest way to edit a video program?
4. What happens to the quality of a videotape when it is copied?
5. What is a character generator?

**CRITICAL THINKING**

1. What did you think was the hardest part of writing a script? Explain.
2. Do you think that you look and sound the same on television as you do in real life? Explain.
3. Many professional actors and actresses get very nervous just before performing. Why do you think some people get "stage fright"?
4. Research how long it takes to produce one television show. Call your local station to find a list of the jobs related to television production.