Chapter 3
The Video Camera and Support Equipment

Introduction

The camera is one of the first pieces of equipment that new students gravitate toward because it appears to be the most central item in a television production studio. Good camera operators must first learn the capabilities of their equipment. This chapter presents parts of the video camera, related support equipment, and basic operation procedures.

Objectives

After completing this chapter, you will be able to:

- Explain the differences between the various video cameras available.
- Identify each part of a video camera and note the corresponding function.
- Differentiate between the focal length and the focal point related to a zoom lens.
- Explain the interrelationship between f-stops, the iris, and aperture in controlling light.
- List the challenges and benefits involved in using hand-held camera shooting.
- Identify the types of tripod heads available and cite the unique characteristics of each.

Important Terms

Aperture | Lens
---|---
Auto-Focus | Optical Center
Auto-Iris Circuit | Pan Handle
Camera Control Unit (CCU) | Pedestal Column
Camera Control Unit | Pedestal Control
Camera Head | Remote Control Unit (RCU)
Charge Coupled Device (CCD) | Studio Camera
Docking | Studio Pedestal
Dolly | Subjective Camera
Fluid Head | Target
Focal Length | Tripod Head
Focal Point | Variable Focal Length
Focus | Lens
Friction Head | Viewfinder
F-Stop | Zebra Stripes
Gain | Zoom In
Hot | Zoom Lens
Iris | Zoom Lenses

Production Note

In the classroom environment, it is not necessary to have "professional broadcast quality" cameras in order to effectively learn video camera operation. In making this decision for my own classroom, I discussed with a vendor whether I should spend a sizeable amount of money for one "broadcast quality" camera or the same amount of money for several "non-broadcast quality" cameras. My vendor's comment on the situation made very good sense. "You are teaching students to take pictures and, when you get right down to the bottom of things, all cameras point." As a result, I bought several good quality cameras rather than one high quality camera, which would not teach students anything more than the cameras I bought. The additional cameras also allow more students to get experience operating a camera without waiting in line for one to become available.

Types of Video Cameras

Several types of video cameras are available for professional use. Each camera type offers unique benefits and restrictions.

Studio Cameras

The studio camera is usually very large and too heavy to be used as a remote camera in the field. Because of its size, studio cameras may be placed on a three-legged stand, called a tripod, for support. To allow smooth camera movement, the feet of the tripod are placed into a three-wheeled cart called a dolly. Figure 3-1. A studio pedestal is another common type of camera support. The camera is attached to a large, single column on wheels that is pneumatically or hydraulically controlled, Figure 3-2. The size, weight, and mount of the studio camera dictate that it not be taken out of the studio.

Talk the Talk

When referring to multiple camera dollys, the correct spelling of the term is “dollys.” This rule applies only when making reference to this particular piece of equipment.
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Figure 3-1
When a tripod is secured into a dolly, the camera may be moved smoothly across the studio floor.

Figure 3-2
Placing the camera on a pedestal provides a steady and smooth shot while in the studio. (Vinten Broadcast Ltd.)

Camera control unit (CCU): A piece of equipment that controls various attributes of the video signal sent from the camera and is usually placed in the control room or the master control room. Also commonly called a remote control unit (RCU).

Visualize This
The video engineer adjusts the settings on CCUs to match the signal from each camera to the others in the studio. The following scenario is likely to occur when cameras are not matched:

The on-screen talent is wearing a red dress and three cameras are shooting her. Every time the switcher cuts from one camera to another, the color of the dress changes from a shade of purple to orange to pink. This creates problems in the editing room during post-production.

Camcorders
Professional camcorders are lightweight, portable cameras, Figure 3-5, but are not quite as small as consumer camcorders. Professional models have many more internal components. The professional camcorder is a television camera and recorder in one unit and is relatively simple to take into the field. While in use, it is placed on the operator’s right shoulder or on a field tripod.

Each studio camera comes with a camera control unit (CCU), sometimes referred to as a remote control unit (RCU), Figure 3-3. The CCU is a piece of equipment that controls the video signal sent from the camera and is usually placed in the control room or the master control room. The CCU controls many signals from the camera, including the color, tint, contrast, and brightness. The video engineer manipulates the CCU controls to match the signal from each camera involved in the shoot, Figure 3-4.

Figure 3-3
The video engineer uses the camera control units (CCU) to adjust the attributes of studio cameras from the control room. This provides a central location for one person to control all the cameras, rather than adjusting the settings on each camera itself on the studio floor.
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Viewfinder

Figure 3-5
A professional camcorder can produce high-quality pictures outside of the studio.

Convertible Cameras

A convertible camera may be purchased with a variety of accessory packages that make it operational in a studio, as a portable field camera, or both. Many small-scale studios purchase convertible cameras because they are adaptable to a variety of situations and are often less expensive than larger studio cameras.

Camera Head

The camera head, Figure 3-6, is comprised of four major parts:
- Camera Head
- Viewfinder
- Camera Lens
- Recorder

The studio package configuration of a convertible camera includes a CCU and a viewfinder (a small television monitor). Studio viewfinders measure at least 5" diagonally. The camera operator stands several feet behind the camera, so the image must be large enough to be seen at that distance.

A remote camera package configuration usually includes a 1" viewfinder. The operator is likely to have the camera on his shoulder with his right eye pressed against the eyecup of the viewfinder, so a larger viewfinder is not necessary.

Television Production

Even a convertible camera, which may be configured either as a studio camera or a remote camera, has the same basic four components as other types of video cameras.
is split, usually by a prism, into individual red, green, and blue beams. Each beam hits the photosensitive surface, or the target, of the corresponding charge coupled device (CCD). The photosensitive elements on one side of the dime-sized CCD convert the light into an electronic, or video, signal. The video signal exits on the opposite side of the CCD and enters the rest of the camera. The charge coupled device is more commonly referred to as the “CCD” or “chip.” Professional cameras contain three CCDs, one for each colored light beam.

**Gain Control**

**Gain** is the strength of the video signal. Some cameras have a “gain select” or “gain switch,” while others may have the feature available through a menu option. On a studio camera, the control may be located on the CCU. If this function is available, you should be aware of its effect on the recorded image. Improper use of the gain switch can result in unusable footage. Adjusting this control allows the strength of the signal going from the camera to the recorder to be increased or decreased. The white level, black level, color, and tint are all equally affected when the gain setting is changed.

When shooting something that is dimly lit, the picture will be dark. In this respect, the camera is no different from your eye. It is difficult, sometimes impossible, for the human eye to see in the dark. A soldier on night maneuvers, for example, absolutely must be able to see in the dark. In this situation, night vision goggles are used. In recent years, news programs have commonly shown images of night vision from war zones. However, these images are not very clear. When a camera is shooting in the dark, increasing the gain may artificially brighten the picture.

As the gain is increased, the resulting image becomes increasingly grainy. This kind of picture is unusable in most professional productions. It is recommended that the gain switch never be moved from the “0” (zero) position. If an image is too dark, a light source should be added.

**Production Note**

The average consumer would say that the gain control adjusts the picture’s brightness. In reality, gain is to brightness as a cubic zirconia is to a diamond. They look similar to an untrained eye, but there are vast differences between them. Adjusting the gain control changes the strength of the actual video signal. In the realm of audio, gain is synonymous with volume. When the brightness is adjusted, the amount of “white” in a picture is increased or decreased.

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**Assistant Activity**

Manipulate the gain control while the camera is attached to a monitor to see the effects on the picture.
Auto-focus is not used on many professional cameras, because focus is a creative tool and professionals prefer to have creative control over the images. As the next chapter explains, the most important items in a shot should never be placed in the center of a frame. Therefore, the auto-focus feature keeps the wrong items in focus. Professionals should always turn the auto-focus option off.

**Production Note**

Many people misuse the word “focus;” they incorrectly use it instead of “zoom.” For example, “focus in on the apple on the kitchen counter.” The word “focus” used in this context actually communicates that the camera should zoom in on the apple on the counter. Use “focus” only when dealing with a picture that is blurry and in need of focus.

**Zoom Lenses**

Most television lenses are **zoom lenses**, in that they are capable of magnifying an image merely by twisting one of the rings on the lens. For example, a camera that is 15′ away from a person can capture a very tight shot of their eyes. The zoom lens may be operated at any speed, from extremely fast to so slowly the audience barely perceives that something is getting larger or smaller. Rotating the zoom lens so that the center of the picture appears to be moving toward the camera is called a **zoom in**. Rotating the zoom lens so that the center of the picture appears to be moving away from the camera is called a **zoom out**.

It is very important to understand that a zoom shot does not produce the same effect for the audience as a shot where the camera physically moves toward the subject, or a dolly shot. A dolly shot, discussed further in the next chapter, takes the audience into the set in the same way a person moves through his environment. A dolly actually changes the perspective. The natural picture from a dolly shot, without a zoom, is three-dimensional and more realistic. When zooming in, the center of the picture gets larger; it is magnified. It does not appear as though the camera moves closer to the object, only that the center of the picture is larger. The zoom makes it possible to get a close-up of an object without physically moving the camera over uneven terrain. With a zoom shot, however, the image takes on a flat appearance.

**Optical center:** The physical location within the lens assembly where an image is inverted. Also called the **focal point**.

**Zoom lens:** The particular piece of glass within the lens assembly that moves forward and back, magnifying or shrinking the image accordingly. This individual lens is the focal point, or optical center, of the zoom lens assembly.

**Focal length:** The distance (measured in millimeters) from the optical center, or focal point, of the lens assembly to the back of the lens assembly.

**Focal length:**

When an image passes through a zoom lens, it is turned upside down, or is inverted. The physical location within the lens assembly where the inversion occurs is called the **optical center**. Another name for the optical center of the lens is the **focal point**. The optical center, or focal point, may not be in the center of the lens assembly as measured in inches, Figure 3-8. For example, the center is 3” on a lens that measures 6” long from front to back. The optical center is the point where the image is inverted, regardless of the physical location inside the lens assembly or the distance from the front or back of the lens assembly.

As the outside ring of a zoom lens assembly is rotated, one of the individual lenses inside the lens assembly moves backward or forward. You can see this movement by looking into a zoom lens as it is manipulated. As this piece of glass moves forward and back, the image is magnified or shrinks accordingly. This particular moving piece of glass within the lens assembly is called the **zoom lens**. This individual zoom lens is the focal point, or optical center, of the zoom lens assembly. The image is inverted wherever the zoom lens is positioned, within the range of the lens assembly, Figure 3-9.

**Visualize This**

Imagine that you are standing in the front of the classroom, facing the students. From this vantage point, some of the students in the third row of desks, positioned horizontal to you, are not completely visible. Parts of their bodies, such as arms or hands, are blocked by students in the first and second rows. From your perspective, Rachel’s left arm and hand are hidden. If you take a few steps down the aisle to stand even with the second row, you can see Rachel’s arm on her desktop without a problem. As the camera (your eyes) moves into the set, the viewing perspective changes. Your body’s movement is a dolly move. Another result of the dolly move is that Rachel gets larger in the picture because you are closer to her. Move back to the front of the class to examine this situation with a camera zoom. Rachel’s left arm is blocked from view again because Bill, in the second row, is obstructing your view. Do not take a single step toward Rachel. Instead, pick up a pair of binoculars and view Rachel through them. She is larger in the picture, just like in the dolly, but you are still unable to see her arm. This is because Bill is larger now as well, and is still blocking your view. This movement is like a zoom shot with a video camera because it does not change the visual perspective. You will not see Rachel’s left arm until either you move, Bill moves, or Rachel moves.

**Zoom Out:**

The act of rotating a ring on the zoom lens so that the center of the picture appears to be moving away from the camera. Also called a **variable focal length lens**.
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**Figure 3-8**
The optical center of a lens is not always in the physical center of the lens.

**Figure 3-9**
The individual zoom lens slides forward and backward within the zoom lens assembly. The focal point is located wherever the zoom lens is positioned.

**Figure 3-10**
The focal length is the distance (in millimeters) between the back of the lens assembly and the focal point.

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**Variable focal length lens**: A lens in which the optical center can vary its position within the lens assembly, varying the focal length measurement as well. Therefore, a zoom lens is a **variable focal length lens**.

**Controlling Light**

There are at least three moveable rings on a professional camera lens assembly, **Figure 3-11**:

- The focusing ring is furthest away from the camera body. This ring adjusts the focus of the image in the frame of the picture.
- The zoom ring is in the middle of the lens assembly and moves the zoom lens forward and backward.
- The f-stop ring is the ring nearest to the camera. This ring is an external indicator of the amount of light passing through the lens and reaching the CCD.

Three specific components of a lens assembly work together in regulating the light: aperture, f-stops, and iris.

**Visualize This**

When you enter a dark movie theater, your eyes dilate. The part of your eye that determines eye color, the iris, contracts. When the iris contracts, the pupil gets larger. The pupil is the black part in the center of the eye that is essentially a hole that lets light into the eye. With the pupil enlarged, more light can enter the eye to reach the rods and cones of the retina. This allows you to see in a darkened room. When you exit the theater and go back into the bright daylight, you squint and the iris expands. This makes the pupil smaller and reduces the amount of light hitting the rods and cones. If the iris cannot expand enough to sufficiently reduce the amount of light hitting the retina, you continue to squint until you get a headache or find sunglasses to further reduce the light hitting the retina. The television camera lens is asked to operate the same way as the human eye when reproducing colors and tones and reacting to changes in the environment’s light. It valiantly tries, but does not succeed. The camera lens needs a human to help it operate.

The **aperture** is the opening, adjusted by the iris, through which light passes. Aperture is nothing that can be touched; it is a hole.

The **iris** is comprised of blades that physically expand and contract. The movement of these blades adjusts the size of the opening that allows light to pass through the lens, **Figure 3-12**. A camera’s iris operates much like the iris of the human eye. As the size of the iris increases, light is blocked from passing through to the CCD. When the iris contracts, more light is allowed to pass through.
Many consumer and professional cameras have an auto-iris circuit, as well as a manual iris control. The auto-iris circuit examines the light levels coming into the camera and opens or closes the iris according to the generic definition of a “good” picture. The auto-iris is a useful feature for most circumstances in television production.

Many cameras offer a manual iris control in addition to the automatic circuit. Adjusting the iris manually is accomplished by moving the f-stop ring. The f-stop setting determines the amount of light that passes through the lens by controlling the size of the iris. If the camera lens has a manual f-stop ring (some consumer cameras do not), numeric values written on the corresponding moveable ring, Figure 3-13. When the f-stop ring is manually turned, the operator hears or feels a series of clicks or bumps that indicate movement from one f-stop to another. Lower f-stop settings (numbers) allow a greater amount of light to pass through the lens. Higher f-stop numbers indicate that smaller amounts of light can pass through. The appropriate f-stop setting varies per situation, based on the lighting in the environment and the brightness of the object(s) in the shot.

**Visualize This**

To understand the purpose and function of f-stops, consider the speedometer of a car. While driving a car, you look at the dash and see that the speedometer indicates you are traveling at 40 miles per hour. You want to accelerate to 55 miles per hour. To accomplish this, you reach your hand forward and push the needle of the speedometer with your finger up to 55, right? Of course not. Moving the needle of the speedometer does not increase the speed of the vehicle because the speedometer does not contribute to the car’s performance. It only indicates what the car is doing. The accelerator increases the gasoline flow to the engine, which then works faster and causes the car to increase its speed. On a camera, the f-stop ring is the speedometer, the iris is the accelerator, and the amount of light passing through the lens (aperture) is the speed at which the car is traveling.

When shooting in high contrast situations, however, the auto-iris essentially becomes confused. It first adjusts to produce a good picture of the darker items, but the light items then begin to glow. When automatically
adjacent for the light objects in the frame, the dark items lose all detail. The auto-iris should be disengaged in this type of situation. If this feature can be disengaged, manually adjust the f-stop ring to produce the best quality picture.

**Production Note**

It is important to remember how the aperture, f-stops, and the iris relate to each other. The f-stop indicates the size of the iris, which creates the size of the aperture.

**Recorder**

On many camera systems, the recorder is a separate part that is directly connected to the camera head. This allows a variety of video recorders to be used with a single camera head. Attaching the recorder to the camera head is not necessarily done with a cable. A short cable may run from the back of the camera and down to a recorder hanging off the camera operator’s shoulder. Most recorders, however, attach directly to the camera head by sliding into a notch on the back of the head. The camera and recorders that are designed to dock to each other are called “dockable.”

**Mounting the Camera**

There are two basic ways to support a camera while in use:

- Hand-Held Shooting
- Tripod Shooting

**Hand-Held Shooting**

Many consumer cameras are literally held in the operator’s hands. The size and weight of most professional cameras make it difficult to be held in the operator’s hands for any extended amount of time. Professional cameras usually rest on the right shoulder of the operator, with both hands holding the camera lens steady. The right hand is positioned inside a strap holding it to the zoom lens control. The left hand holds the focus ring of the lens. See Figure 3-14.

At first glance, the hand-held camera technique appears easy. The operator does not need to be concerned with carrying and setting up a heavy tripod. However, hand-held camera operation quickly loses its appeal when gravity takes its toll. The camera operator’s arms tire quickly, and the heavier the camera is, the faster this happens. The result is very poor camerawork. An unsteady camera shakes, wiggles, tilts sideways, and eventually begins to point at the ground. Even if the camera is hand-held for a short time, the shot moves with every rise and fall of the camera operator’s chest while breathing.

**Production Note**

Professionals do not operate a camera with only one hand! The right shoulder bears the brunt of the weight of the camera. The right hand is positioned inside a strap holding it to the zoom lens control. The left hand holds the focus ring of the lens. Both hands should be on the camera when operating with the hand-held technique. A stable picture is virtually impossible if only one hand is used. Additionally, a $15,000 to $60,000 camera is very unlikely to fall off your shoulder when held with both hands.

If the lens is zoomed in on a person or object, the slightest shake or wobble is amplified. The resulting image is annoying to the audience. The further the lens is zoomed out, the less noticeable any shaking takes place. The camera operator can make use of items in the field to help steady a hand-held camera. A—One technique is to lean against a wall. This essentially makes the operator two legs of a tripod, with the wall as the third. B—An open door can be used to create tripod-like support for the camera operator. The open door is one leg, the roof is another leg, and the operator’s legs are the third leg of the makeshift tripod.
becomes. Therefore, always operate in the “zoomed out” position when hand-holding a camera. To get a close-up, move closer to the object; do not use the zoom.

If it is absolutely necessary to hand-hold a camera, brace yourself against a wall or tree, lean against a car door, or lie on the ground, Figure 3-14. Hold your breath to get the shot while steady, but realize that nothing will be usable beyond 5–10 seconds. There are many hand-held shots in the news, but the image cuts from one shot to another in the stories from the “field.” Anyone can hold a steady shot for a few seconds. The editor cuts out all the shaking shots.

The Glidecam™ is a device that attaches to a harness worn by the camera operator, Figure 3-15. This harness is similar to that worn by a bass drummer in a marching band. A spring-loaded and shock absorbing arm is attached to the harness. The camera attaches to the arm using the same kind of mounting plate found on tripods. Using the Glidecam, the weight of the camera is taken by the harness and, therefore, by the operator’s entire torso. Because the arm is spring-loaded, the camera shot is kept steady even while the operator climbs steps, runs, or walks.

Assistant Activity
To help you understand how a Glidecam type assembly works:
1. Fill a 16 oz. drinking glass with water to ½” from the top.
2. Hold the glass in your hand with your arm curved as it would be if you were holding the pole of a carousel horse.
3. Keep your arm in this position and walk, run, go up and down stairs, or dance without spilling a drop of the water.

How is it possible that the water does not spill? The muscles in your wrist, arm, elbow, and shoulder act as spring-loaded shock absorbers. If you hold the glass to your chest, with the knuckle of your thumb actually touching your chest, the water will spill almost immediately upon moving. The shock absorption has been removed and the glass is directly attached to the motion of your body.

The Glidecam arm absorbs the shock of motion in very much the same way as your arm does in this activity.

Subjective Camera

Subjective camera is a special hand-held camera technique, Figure 3-16. The camera itself becomes the eye of one cast member. The viewers see the world through the eyes of that character. Examples of this technique include:

- A camera is mounted in a stunt driver’s car. As the car is driven up and down hills at high speeds, the audience’s stomachs lurch as if they were actually riding in that vehicle.
In a suspense film, the camera is positioned outside a house in the middle of the dark woods. “We” are looking through the branches of a bush into a window of the home. “Our hand” reaches up into the field of view of the camera and pushes away leaves on the bush to clear our view into the house.

Tripod Shooting

A tripod is the three-legged stand to which the camera is attached. The telescoping legs on most tripods allow the operator to position the camera at varying heights. The legs on all tripods spread out from the center. On most tripods, each leg operates independently. This is useful if the camera needs to be set up on a sloped terrain, such as the side of a hill. Each leg can be extended and spread out at different angles, which facilitates level mounting of the camera head on an uneven surface. Most tripods and tripod heads are made with a leveling bubble that assists the operator in ensuring that the camera head is level when mounted. Tripods often have a column in the center, called a pedestal column, to raise or lower the camera. On the side of the pedestal column is the pedestal control, which is a crank that twists a gear to raise and lower the pedestal column.

Hot: The state of a video camera when the image captured by the camera is being recorded. Pedestal up and down only when the camera is not hot. A camera mounted on a studio pedestal, on the other hand, may pedestal up and down with great smoothness.

Mounting Heads

The tripod head is the assembly at the top of the pedestal column to which the camera attaches, Figure 3-17. The tripod head has several handles and knobs. The handles and knobs allow the operator to pan and tilt the camera attached to the tripod head. The tripod head moves on the tripod in much the same way as your head moves on your neck. It can be tilted to point at the ceiling or the floor, or from side to side. One or two pan handles may be attached to the back of the tripod head.

Friction head: A mounting assembly on some tripods that stabilizes the camera using the pressure created when two pieces of metal are squeezed together by a screw. Releasing the pressure (loosening the screw) reduces resistance between the pieces of metal and the parts slide easily against each other. The camera can then be tilted up and down using the handle. This type of tripod head is not usually found in a professional television setup.

The fluid head is similar to the friction head, in that pressure between two pieces of metal restricts movement of the head. However, the fluid head has a thick fluid, such as oil or grease, between the two pieces of metal. This provides additional resistance to movement. The tripod head can be loosened, but is never completely free to move without resistance.
Camera operators prefer more resistance to create smooth and stable camera movements. If the head were completely resistance free, the camera would move with the slightest twitch or breath of the operator. The fluid head allows the camera operator to place fluctuating levels of pressure on the head, without moving the head until enough force is intentionally exerted. This prevents camera movement caused by slight touches on the pan handles.

**Visualize This**

To help you understand how a fluid head provides greater resistance:
1. Swing one of your arms while standing in a room. Notice the free movement of your arm.
2. Imagine that you are standing in water up to your neck moving your arm the same way. The fluid (water) provides some resistance to movement and you have to work a bit harder to create the same motion.
3. Imagine standing in a pool of oil swinging your arm. It would be even more difficult to move.

Increasingly thicker fluids provide greater resistance to movement.

**Camera Care and Maintenance**

To help ensure the highest quality images, proper care and maintenance of video equipment is necessary. The recommended handling includes both appropriate cleaning and storage of equipment.

**Cleaning a Dirty Lens**

As with other pieces of video production equipment, the camera lens is delicate and requires special care when cleaning. Commonly used cleaning solutions and materials are not appropriate for use on a camera lens.

Seeing little spots on a camera's viewfinder is not necessarily an indication that the lens is dirty. Perhaps the dirt is on the front of the viewfinder. Clean the viewfinder with a soft cloth. If this does not remove the spots, the lens should be cleaned. The following are some firm rules about cleaning lenses:
- Never touch a lens with your bare fingers.
- Never use a cloth or tissue moistened with saliva to wipe a lens clean. Saliva ruins the lens.

**Post-Production Camera Care**

While not in use, both studio cameras and camcorders should be stored in a protected and temperature-controlled location. All the related cables should be coiled and stored with the camera or camcorder.

Guidelines for care of a studio camera:
- Lock the pedestal and camera mounting head to prevent movement while not in use.
- Close the iris and attach the lens cap.
- Move the camera to a safe location within the studio.

Guidelines for care of a camcorder:
- Remove the videotape from the camcorder.
- Close the iris and attach the lens cap.
- Power-off all the camera functions (light, microphone, recorder).
- Detach the camera from the tripod when transporting the equipment.
- Place the camera in its case for storage and transport, **Figure 3-19**.
Wrapping Up

The television production industry is labor and skill intensive. Careers in this industry require long hours of work. On the other hand, it is difficult to find anyone working in the television production industry who does not like his or her job. Think about high school football players. Every August, before the school year even starts, they go to school and practice outside in the summer heat for hours on end. To them, it is not work. Most people in the television production industry do not refer to their job responsibilities as work. The say things like:

- “I have a shoot today.”
- “I’m going to the studio.”
- “I’m starting to edit now.”

The word “work” is not used in normal conversation with production people, because most consider it fun.

Review Questions

Please answer the following questions on a separate sheet of paper. Do not write in this book.

1. List the parts of a studio camera and note the function of each part.
2. How does the appearance of an image change when the gain is adjusted?
3. What is the optical center of a zoom lens?
4. Explain the significance of the numbers printed on the f-stop ring of a camera lens.
5. What challenges are presented when hand-held shooting with a professional camera?
6. List the benefits of using a tripod when shooting outside of the studio.
7. What is the difference between a friction head and a fluid head?
8. What are the appropriate materials to use when cleaning a camera lens?

Activities

1. To illustrate the proper result of focusing a camera lens, perform the following:
   1. Place a piece of white paper on the right side of a piece of black paper.
   2. Point a camera at both pieces of paper.
   3. Move the lens so that the camera is out of focus.
   4. Notice that the left edge of the picture is clearly black and the right edge is clearly white. It is difficult to determine where the image turns from black to white, as the center of the picture is gray.
   5. Twist the focus ring of the lens, slowly bringing the picture into focus.
   6. The center of the picture becomes less and less gray and the image becomes sharper. When the picture is completely “in focus,” the separation between black and white is as sharp as possible.

2. Create an analogy (a written paragraph or an illustration) that effectively explains the relationship between f-stops, the iris, and aperture.