

Camera Issues

A wise old Cinematographer once said, “Failing to prepare is preparing to fail.” There are many areas of the technology of digital cameras in which a cinematographer should have at least some working knowledge, if not a thorough understanding. Knowing the issues and concerns in advance helps us to prepare, and hopefully by preparing properly, to avert potential problems or failures down the road. An understanding of camera issues therefore seems to me to be essential to the job of the cinematographer.

Camera and Lens Package Types

Most cameras can be outfitted to perform a variety of tasks, but rental houses charge for gear by the piece. Although accessories are usually pretty cheap to rent, it all adds up, so when you are filling out the camera order, work from the script to determine what accessories you must have, and what you can live without. The difference between a correctly configured studio camera package and a correctly configured portable run-and-gun package can mean quite a difference in cost.

Similarly, consider the size of the lens package that you order (see Figure 8.1). Lenses are the most expensive discretionary items on your list, and when you are searching for something to help you get down to the budget number your production has for cameras, look for redundancy in lenses.

It helps to ask realistically yourself, “What lenses must I have every day, and what lenses must I have for special shots?” The first assistant director can add specialty camera item days to his breakdowns and call sheets so that they can be scheduled or, more

important, flagged when they are rescheduled! The camera rental company can then be informed on a day-to-day basis of special needs and short-term additions to the camera package.



Image courtesy of Gareth Paul Cox

Figure 8.1 There are a lot of lenses to choose from!



Image courtesy of Alex Jamagin

Figure 8.2 Steadicam in action.

Steadicam work is very specialized, and most Steadicam operators are by necessity owner/operators; as such, they are usually very well equipped for the task (see Figure 8.2). Most often their greatest need is for the time to prep properly and configure their rig for the cameras they will be using.

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Image courtesy of Shane Hurlbut

Figure 8.3 Crashcam housing.

Also keep in mind if you are doing action work or stunts, it might be necessary to bring in short term

extra cameras other than the main camera during the course of shooting. Consider that a dangerous car stunt might be better cost managed by using a cheaper camera in harm's way, perhaps a crash cam or DSLR camera if there is a chance of destroying the camera to get the shot.

“Ready to Roll” Capabilities, Boot-Up Time, Pre-Roll On-Set Management of Expectations

I begin every production I work on by reinforcing one important point to the camera crew. If the call time is 7 A.M., then the camera should be on the set, on the dolly or sticks, with a 35mm lens on it, be booted up, and be ready to roll at 7 A.M.—no matter what! This policy has almost always resulted in the evolution of a little wagering game about where the first shot will be, but the result is that no one is waiting on camera when the day begins. The boot-up time of some electronic cameras on set is not a trivial issue, and when the occasional power kickout or camera crash happens, the director, the producer, and the studio all can quickly become very impatient. In some cases, this can become a consideration when choosing a camera, as some cameras reboot and restart much more quickly than do others. Whatever the resulting choice of camera, it is important to gently let your director, producer, and first assistant director know ahead of time that there are going to be some camera reboots, and especially to let them know how long restart routinely takes. It is similarly important to inform the first assistant director and the sound department if the camera being used requires a pre-roll period at the start of each take.

Viewing the Image While Shooting

Viewing system concerns are a very big consideration when deciding which camera to use for a production. Both video viewfinders and on-set monitors (of any size!) are notoriously difficult to use in judging critical focus, so choose carefully. No producer, director, or studio executive that I know of has ever been forgiving about an out-of-focus shot; there is nowhere to hide from bad focus. The viewfinder is the first line of defense against bad focus, so get the best viewfinder available for the camera you choose, and make sure that the operator understands the job of judging focus through that viewfinder.

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Figure 8.4 ARRI ALEXA viewfinder.

Almost always during a shoot there will arise a need to move the viewfinder or reorient it into some awkward or nearly impossible configuration in order to get a shot, so it is important to be sure that the mounting hardware you will need is in the camera package on the truck. Never, ever, ever put yourself in the position of having to explain that you could not get a shot because you failed to bring along the equipment required.

Recently, wireless video transmission technology has reached a point where it can work reasonably well on shoots. For example, if one is shooting to and from several boats in a scene, it is possible to broadcast video from one boat to another, enabling much better directorial control over what happens in the scene. Keep in mind that most such equipment is only usable for viewing, and *not* for actual recording!

The camera operator's ability to follow and capture the action is greatly enhanced by the ability to observe that action with the immediacy of the speed of light! Many HD cameras employ video viewfinders that present a multitude of challenges. Video viewfinders are usually of lower definition than the image the camera actually captures. They have a slight delay between the action in front of the camera and the picture on the viewfinder. They can only show the operator an image that is the same size as the image being captured, whereas an optical viewfinder, like that on the ARRI-FLEX ALEXA Studio, allows the camera operator to see a larger area than the image area of the sensor.



Figure 8.5 ALEXA studio model with optical viewfinder.

This aids in framing fast moving objects, objects moving into the frame, and prevents "microphone dips," when the sound boom operator accidentally drops the microphone into the usable frame area. An optical viewfinder has no delay in the picture; the operator sees what is happening in front of the camera as it occurs.

Viewfinders—A Cautionary Note

In the heat of battle during production, many people may have the need to look through the camera viewfinder, which raises a nontrivial health issue. A number of communicable diseases can be passed via direct contact with the viewfinder eyecup or a chamois eyecup cover, most frequently, "pinkeye." Encourage crewmembers to use the monitors whenever possible, and request extra eyecups and covers. A little hygienic caution can go a long way in preventing annoying and dangerous eye infections!

Video Village

There are as many opinions about the "Video Village" phenomenon as there are filmmakers. Make yourself equally comfortable with either incorporating a Video Village viewing system into your methodology or not incorporating it.



Figure 8.6 Video Village.

This is an area in which, whatever way your director and producers are leaning, you must have a well-thought-out answer for them. Accommodate the directorial interface as your first priority; the director gives you the job, and he or she is your first master. If in the course of preparing for the shoot, the producers or the studio calls the size and scope of the directorial viewing environment

into question, always make the decision a group decision by collaborating with your director.

Creating, Storing, and Recalling Camera Settings

One of the features afforded by many digital cinema cameras is the ability to easily create, upload, and select scene files, which control the settings for many user adjustable parameters.



Figure 8.7 Sony memory stick for saving camera settings.

An onboard memory card slot provides for the ability to quickly save and load scene files or look for a multitude of shooting situations. With these quick setup adjustment files, a user can quickly switch between a tungsten-balanced setting to a daylight setting to a wild or fantastic look setting within seconds. In cameras using raw workflow, these looks can be saved as ASC CDLs or can be embedded as metadata to be applied in postproduction. One word of caution about using cameras that allow deep-menu manipulation of look color and contrast: Once baked into the image, such looks cannot be undone in post!

Weight and Balance Issues

If you are choosing a camera to do a studio production, shot on a stage, where the camera lives on a dolly for most of the show, weight and balance might only be a minor part of the equation. But if the script dictates that you climb rugged terrain, or ford streams, or hike through jungles, it is worth considering that a lighter, more portable camera is more likely to get the crew to the place where the shoot is happening a little earlier in the day, and a little less out of breath.



Figure 8.8 VistaVision camera (circa 1956).



Figure 8.9 ARRI ALEXA M camera head and lens.

Because one of the criteria by which a cinematographer is judged is the amount of work he or she can get done in a day, it becomes crucial to one's career success to make good judgments about what camera to use based on efficiency and the speed at which your crew can work. If the story dictates a lot of Steadicam, or handheld work, it is important to pick a camera or cameras suited for that purpose: one that balances well on the operator's shoulder. A lighter camera with good ergonomics and comfortable shoulder mounts is essential for working handheld day after day. If the story dictates a documentary style of shooting, one might choose a camcorder camera with onboard recording capability. A well-educated cinematographer can let the story inform the choice of cameras. Remember that not every script will lead you to the same camera every time.

Onboard Video Recording Versus Outboard Recording

How will the project be recorded? Is the camera crew going to record the image to onboard recorders? Most cameras feature onboard recording solutions. Whether to use the onboard recording solution is a workflow question, a subject discussed in Chapter 14. Cameras such as the Sony F35 or the Panavision Genesis allow the crew to record to HDCAM SR decks or solid state recorders mounted directly to the top or back of the camera, making the division of labor very much like a traditional film set. ARRI ALEXA and Red Epic allow for the use of onboard solid-state memory cards to record images, and the latest ALEXA models provide an onboard codex digital recorder for recording uncompressed full bandwidth raw signals.



Figure 8.10 Sony F23 with HDCam SR deck mounted.



Figure 8.11 Sony F23 with interface box mounted.

However, sometimes the script dictates tight locations where space and form factor becomes a driving force, such as car interiors or stairways or confined spaces. This can dictate the use of outboard recording systems, connected by single- or dual-link video cables. The Technocrane is a marvel of modern engineering, but it is usually made more efficient by separating the recorder and cable-connecting it some distance from the camera. In some extreme cases, it even becomes necessary to connect the camera hundreds of feet away from the recorder via fiber optic cables. Just remember that when something goes wrong on a digital shoot, it's usually best to begin by troubleshooting the cables!

Onboard Sound Recording Versus Outboard Sound Recording

Similarly, it sometimes becomes important to consider how audio will be recorded. Frequently the sound person will run a cable to an onboard recorder for scratch audio when it has that capability, but occasionally (such as in run-and-gun situations or documentary style shooting) it becomes imperative to record the main audio to the camera. In such

cases the choice of camera should be made in consultation with both the sound and postproduction departments.

Onboard Camera Controls Versus Outboard Camera Controls

Stage shoots, Steadicam shooting, crane shooting, handheld work, and many other shoot parameters beg for camera remote-control capability. In such cases, it is important to choose a camera that integrates with a good remote camera control unit, as well as remote focus, iris, and zoom controls. Interfaces with Preston or C-Motion systems and multi-camera synchronizers, as well as various lens data systems are important to test before leaving the rental house with a camera package.

Ease of Use of Camera Controls

One of the great success stories in camera design is that most camera menu systems and structures have become greatly simplified in the last few years. I said *most* menu systems, not *all*. Every camera available for digital cinematography is still to some degree a beta test site for the manufacturer, and they all have built-in “gotchas” that can keep you from getting the shot your director wants. It is very easy to go out into the field and discover a new software or firmware bug, or to discover that the menu system is too complex to quickly accomplish a special shot, but there is *never* a good way to explain yourself out of the situation. Part of preparing for a shoot is finding those instances in the script that will demand some deeply hidden or arcane camera menu function and testing those functions before the cameras leave the rental house. Many of the current generation digital cinematography cameras allow the user to build presets that include menu functions from deep down in menu trees to be called upon using assignable preset function buttons.

Accessory Design: Focusers, Matte Boxes, and More

There are generally two standards for the design and manufacture of motion picture camera accessories: Panavision and ARRI. By and large, most

camera rental companies and manufacturers alike have come to realize and value the simplicity of standardized common accessories.



Figure 8.12 ARRI accessories.

In many cases, ARRIFLEX accessory standards have become the de facto standard for the industry, simply because ARRI sells its accessories (and has been selling them for more than 50 years!), whereas Panavision only rents its accessories. Panavision has always built to its own standards, but a multitude of solutions for using either standard of gear with the other exists. Nonetheless, in preparing for a shoot, it is still important to consider the multitude of accessories that go into the camera package. There are innumerable filters and correctly or incorrectly sized filter trays, lens donuts to prevent reflections in filters from behind camera, rods and bridge plates to support lenses, camera baseplates, matte boxes and brackets, power adaptors, and the myriad of cables that go into connecting everything, and any one of these accessories can keep you from getting a shot if lost or omitted from the camera package order!

In-Camera, Behind-the-Lens Filtration

Many HD cameras feature onboard behind the onboard, behind-the-lens filters in configurable filter

wheels, some controlled manually and some controlled through menu functions.



Figure 8.13 Onboard camera filters.

Usually these consist of a series of neutral density filters, and sometimes color correction filters for a range of daylight to tungsten corrections, and clear filters (optically necessary when no other filtration is needed). Although the default filters are well chosen to accommodate the needs of most productions, other filters can be substituted into the filter wheels. ALEXA XT and upgraded pre-XT camera systems provide for behind-the-lens ND filters, where the spectral transmission of those filters (provided by ARRI) has no impact on color or resolution. Two cautionary notes must be given here: (1) Never attempt to open up the onboard filter wheel yourself—that is the work of trained professionals! (2) If you do change to your own custom menu of behind-the-lens filters, test, test, and test them thoroughly for correct focus and to ensure that you are getting the effect you think you are getting!

Cables, Cables, and More Cables

Some cameras are well packaged, well thought out, and well suited to moving quickly and efficiently in confined spaces. Others are not. For example, it becomes very difficult to work efficiently inside a moving car if the camera you are using has wires and cables and brackets and accessories hanging off it in every direction.



Figure 8.14 Wires, wires, and more wires!

Clutter on the camera is an invitation to failure. I have a slogan that I recite when a camera fails to give picture: First check the cables—because it is *almost always* the cables that fail!

Camera Power

Camera power is also a concern that should be addressed in camera prep. Camera batteries fail, so area needs constant attention from the camera crew, and this is not an area where you should look for savings. Bring enough batteries for the job and then bring spares, and always have an AC power supply available for each camera.



Figure 8.15 Batteries are included!

Batteries should be tested for charge level during prep, and monitored throughout the shoot. If a battery seems even slightly questionable, it is perfectly within etiquette to send it back to the rental house for

immediate replacement. No one at any camera rental company will ever question the decision to exchange a camera battery. If a battery is questionable, place a big red tape “X” across the top, write a detailed description of the problem on red tape on the top of the battery, and send it for a replacement.

Lens Mount/Optical Block and Back-Focus Problems

Modern cine lenses can be quite heavy. For example, the Angenieux Optimo 24–290mm zoom lens weighs 24 pounds and is more than 17 inches long. Often, the lens mount in most digital cameras is secured to a stainless steel optical block in the front of the camera by four to six small screws. A lens of that size and weight can exert enormous leverage on the lens mount.



Figure 8.16 A large zoom lens mounted on an ARRI ALEXA.

Consider that lens mounts are calibrated to lenses with accuracy measurable in thousandths of an inch; it only takes a microscopic change to the flange focus distance calibration to invalidate the focus marks on the lens barrel. It is very important to exercise caution when mounting large and heavy lenses to digital cameras, so as not to distort, stress, or break the components that secure the mount to the optical block. Large or heavy lenses should always be supported by the hands of a camera assistant until a bridge support bracket has been correctly positioned and secured under the front lens support stud. A long and heavy unsupported zoom lens on a bumpy road is capable of ripping the entire lens mount right off of *any* camera!

Shooting Log and Shooting Raw

Directors, producers, and studio executives generally have no idea what they are looking at when shown log images. Because log images do not look like the

finished product, it is very nearly impossible to satisfactorily explain to nontechnical viewers why log images look the way they do.

Sometimes when talking with directors, producers, and studio executives, it can be helpful to say that the log image is the digital equivalent of camera negative—you do not judge color from it, but you can tell if your exposure was OK, whether the mike boom dangled into frame, and so on. When talking with a film-oriented cinematographer, it can be useful to say that log is the digital equivalent of a lab interpositive: flat, and with the densities of the whole image shifted upward together to give your colorist some latitude in which to work.

The value of acquiring images in log color space or raw is not in dispute. Both offer substantial increases in color latitude and image control in postproduction. The understanding of how to view and use log or raw images is a matter of education. This book addresses recording and postproduction of log and raw images in other chapters, but the issues of viewing those images on set must be addressed here, as a camera issue.



Figure 8.17 Log C, Rec 709, and custom look compared.

Most log camera workflows allow for use of on-set viewing look-up tables, or LUTs, which can be generated by a variety of on set or postproduction color correction utilities to be detailed in Chapter 13, the look management section of this book. These LUTs can be used on a variety of monitors detailed in Chapter 15, the displays section of this work. Color correction information generated on set can be saved as nondestructive ASC color decision list (CDL) files, which can be used to transmit on set corrections to postproduction to be used in grading on almost any color corrector (rather than “baking in” a look on set).

The colorist can either use these CDLs as a starting point for the grade, or use it as a reference to be matched using their own grading techniques.

ASC CDLs are covered more deeply in Chapter 13, the look management section of this book. No matter what package is used to create the necessary transforms, or what hardware is used to view those

transformed images, a thoroughly tested and proven on-set viewing workflow implementation is essential to correctly display log images for general consumption.

Digital Still Cameras Used for HD Shooting

Cinematographers are creating many interesting images for motion pictures and television work with DSLRs. There are many times when it helps to have stealth in your toolbox. If you want to work unnoticed in a public place, a bigger camera might attract attention; people might just stare into the camera, whereas if you are just shooting with a still camera on a tripod, you can grab an establishing shot of traffic going by for a movie or a TV show, fairly efficiently, without interference, and without attracting too much attention.

The success of DSLR cameras in motion picture work is in many ways a barometer of what cinematographers really want: a camera that is smaller, lighter, more affordable, and easier to use—one that produces good looking pictures.

In the 1940s and 1950s, cinematographers shot movies and television with big, heavy cameras such as the Mitchell BNC and BNCR.



Figure 8.18 The Mitchell BNCR.

At just over 100 pounds each, the Mitchell BNC (Blimped News Camera) and later the BNCR (Blimped News Camera Reflex) were mainstays of Hollywood film and television production through the 1950s, 1960s, and 1970s.



Figure 8.19 The Legendary ARRI FLEX IIC Reflex 35mm handheld camera.

Then along came the ARRI FLEX IIC, a World War II by-product, and every cameraperson had to have one, because it was so much smaller and lighter. Who cares about the racket it makes? We can hand-hold the camera!

In the digital age, the Canon 5D Mark II, Mark III, and DSLRs in general have reinvigorated the same revolution in camera ergonomics. Cinematographers can use DSLRs to get shots that cannot be shot as easily or should not be shot with a bigger, more expensive camera. If the story dictates putting a camera on train tracks to get run over by a train, the cinematographer can go to the producer in good conscience and offer to make the shot with an expendable DSLR.



Figure 8.20 Canon EOS 5D Mark II.



Figure 8.21 Canon EOS-1D.

There is a lot of powerful image processing going on inside DSLR cameras, and they are doing significant dark noise subtraction to quiet sensor noise, giving very quiet blacks. DSLR cameras currently output HD for motion imaging, so we cannot yet derive the full benefit of raw files from them. The workflow for integration of many DSLR images into motion pictures is 8-bit H.264 and is fairly high in compression; the images look good, but some image criteria can stress the bit depth and compression, making them generally unsuitable for most visual effects work and sometimes resulting in color aliasing.

There are physical limitations when using DSLRs on set. If the cinematographer puts a cine lens and follow focus on a DSLR without putting the camera on a fairly solid platform, live hand focusing can deflect the camera. Focusing can cause the camera to point down and away or up and away, causing movement in the framing from the torque of the focus puller turning the focus knob with his or her hand. Many cinematographers that have used DSLRs for motion picture and television work are coming to feel that a camera should have some weight and mass. Nonetheless, there are many shots that a DSLR can easily capture that you could not or would not attempt with a bigger, heavier, or more expensive camera.

The consensus among cinematographers with whom I have spoken is they would prefer a camera weighing about 20 pounds for handheld work, though many would be happy with something lighter. There is almost universal agreement on the subject of ergonomics: The Aaton was the best camera ever made in terms of comfort, weight, and balance. Cinematographers

agree about how they could perch it on their shoulders forever and that it felt like one was shouldering a sleeping cat. (There is equally universal nostalgia for the wooden handle).

Shooting Handheld¹

The best handheld sound camera I ever used was the Panavision Platinum camera. With a lens, lightweight 400-foot mag, Preston MDR, focus motors, matte box, and onboard monitor, the camera weighed in at about 45 pounds. The best handheld camera for action that I have ever used was the ARRI 235. With a lens, 400-foot dolphin mag, Preston MDR, focus motors, matte box, and onboard monitor, it weighs in at 26 pounds.



Image courtesy of Shane Hurlbut

Figure 8.22 Shane Hurlbut in action: “Make It Weigh a Ton”.

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Operating with some girth on your shoulders gives you control. Having a shoulder cam rig that fits and conforms to your body is paramount. You need it to feel like it is attached to you as well as being perfectly balanced.

Digital Media, X-Rays/Magnetometers, and the Transportation Security Administration

If you must check camera equipment as baggage on a plane, you will want to be able to lock the case with a Transportation Security Administration (TSA)–approved lock, so that TSA personnel will have the appropriate keys to open the lock without having to cut it. TSA personnel can then relock the case after inspection. Bags checked onto an flight are always x-rayed, but X-rays do not seem to have any measurable effect on cameras.



Image courtesy of Ian Duke

Figure 8.23 Count on being x-rayed.

If you want to ship tapes that have been recoded with data, they can go either as checked baggage or as carry-on baggage, with one caution: X-rays will not kill tape or disk drives, but they can cause dropouts on magnetometers and magnetic resonance imaging devices.

Digital Cameras and Cosmic Rays

Many manufacturers of digital cameras will lead-wrap cameras for shipping long distances or polar flights on airlines. Some sensors are more susceptible to damage from prolonged exposure to high altitude radiation, so let the rental house know where you are going and how long the flight will be.



Image courtesy of Gareth Paul Cox

Figure 8.24 Heading over the pole to location at 35,000 feet.

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Radiation exposure to passengers and crew in high-flying aircraft is caused by subatomic particles and “rays” of energy, such as gamma rays and X-rays. Such radiation is produced by the interaction with the Earth’s atmosphere of high-energy particles (primarily protons and alpha particles) that come from a variety of cosmic sources in our galaxy and

from our own sun. Altitude, latitude, and duration all enter into the exposure equation. The higher we go, the greater the dose, the closer we get to the poles, the greater the dose, and the longer we stay aloft, the greater the dose. Check your camera thoroughly for burned-out pixels or lines if you have flown over the North Pole to get to your distant location.

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