



Figure 4.1 Three generations of camera tubes. The largest one is an image orthicon (IO). It was the mainstay of early black-and-white cameras and the first couple of generations of color cameras. The middle tube is a Vidicon. Much simpler in design and more dependable than the IO, it had lower sensitivity and resolution. Thus it was relegated to "industrial" grade cameras — although at least one broadcast color camera used a mix of IOs (for luminance) and Vidicons (R.G.B). The third tube is a Plumbicon, the final generation of broadcast imaging tubes. This tube had a number of derivatives. The Plumbicon had good sensitivity and resolution, and tended not to burn images into its target.

Figure 4.2 Opposite: This camera was first introduced in the late 1940s. The 10:1 zoom lens on the front wasn't introduced until the late '50s. The TK-10 was the studio version, while the TK-30 was the field version. The field version had handles on the camera control unit (CCU) and the associated power supply. The complete camera chain could consume as much as 1600W, of which as much as 400W was directly converted to heat to drive the filaments of the many tubes used throughout the chain. The suitcase-like camera control unit weighed 65 lbs., and the power supply weighed 62 lbs. (Source: Chuck Pharis collection on display/NAB2002)

Early Television Cameras

Coaxing Television Out of the Studio

People who often work in television are asked if they are cameramen. Naturally, it's the most visible part of a television remote to civilians. While audio mixers would probably argue the point, cameras are what differentiate a television remote from a radio show.

Putting a television camera on the road in the early days of television broadcasting was often a daunting task. There were only two basic video sources available in the '40s and the first half of the '50s. The first was the television camera, and the second was basically a television camera adapted to look into the lens of a film projector. So, initially, only important events that could not be staged in a studio (sports, inaugurations, state funerals) were covered. Now, cameras have shrunk from the size of a small refrigerator to the size of a tube of lipstick, bringing all kinds of interesting points of view to the home viewer.

These early cameras needed a fairly thick multicore camera cable to connect the camera head to the CCU, and lots of light (many cameras had their own light mounted on top). And they were only black and white. Voltages as high as 1500V were required out in the head to power the Orthicon image tubes. The picture was harsh, and the Orthicon pickup tube was sticky, and it burned easily. If the camera operator happened to find the sun, a new tube was probably in order. After use, the cameramen spent much time shooting white cards to "de-burn" the tube. To try and stop the tube from burning, the cameras had an option called an orbiter. It consisted of a motor mounted to the side of the camera that slowly rotated the position



Figure 4.3 Another TK-30 with an early version of a zoom lens. The camera behind this one, a GE PE-11, has an orbiter mounted to its side. (Source: Chuck Pharis collection on display/NAB2002)

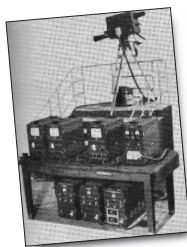


Figure 4.4 Besides RCA and GE, the Du Mont Company also offered early television cameras. Here is a camera head, sitting above CCUs (on top of the table) and power supplies (on the floor).



of the yoke and tube to move the image continually. But it was noisy. It often had to be turned off for close-ups.

On remotes the need for multiple cameras quickly became apparent. Initially cameras had no zoom lenses, so the only way to go from a wide shot to a close-up was to change the lens — with the ensuing black as the lens racked over — or cut to another camera. No director really wanted to see a new lens racked on a camera when that camera's tally light was on. So on most early remotes there were two and usually three cameras. This was good, since you could usually manage to keep two working most of the time.

“Trucking” or “dollying” the camera was the only way to tighten in on a subject without changing the lens. It is still used extensively in the film industry, but many lament that it is so underused in television today. Often we seem to zoom just because we can. Today the 70:1 zoom is found on many sports remotes. Lenses with zoom ratios as high as 87:1 can be found. Where 15 years ago, head-to-toe shots were all that the 30:1 zoom lens could provide from the camera at the 50-yard line, now the nose shoot is creeping into some football coverage, thanks to these big zoom lenses.

Early television equipment was not reliable, and wasn't usually designed to be bounced down the road in a truck. These early cameras ran hot. They tended to bake themselves into unreliability, especially if used out in the sun a lot. The jostling that came with constant assembly and disassembly, and being bounced down the road meant that truck crews were continually fighting camera problems.

These cameras had approximately 50 amplifying tubes spread throughout the head and CCU. The first generation of color cameras that followed had over 200 of these tubes. That number posed a significant maintenance burden, and the processing power in those cameras compared to today's was minuscule.

Du Mont was a vertically integrated television company much like RCA was at the time, only smaller. It manufactured professional broadcast equipment, television receivers, and even had a television network. Du Mont was the original fourth network. Many notable early shows, such as *The Honeymooners*, got their start on the Du Mont network. But, for a variety of reasons, the network went dark in 1956, soon after Du Mont merged its broadcast equipment line with Fairchild Camera and Instrument, and sold its television set manufacturing to Emerson Electric. The television stations that Du Mont owned, which formed the base of the network, were spun off into a separate company initially known as Du Mont Broadcasting. The company went through a couple of name changes over the years and eventually became known as Metromedia. Rupert Murdoch purchased Metromedia to form the initial core of the FOX Network.



Figure 4.5 Early remote production equipment. On the floor under the table at extreme left and right are the power supplies for two TK-30 cameras (a spare is sitting second from left). The other two cases are a sync generator and its power supply. Sitting on the table from left is an audio mixer, two camera control units, a video switcher and a program monitor. (Source: Chuck Pharis collection on display/NAB2002)

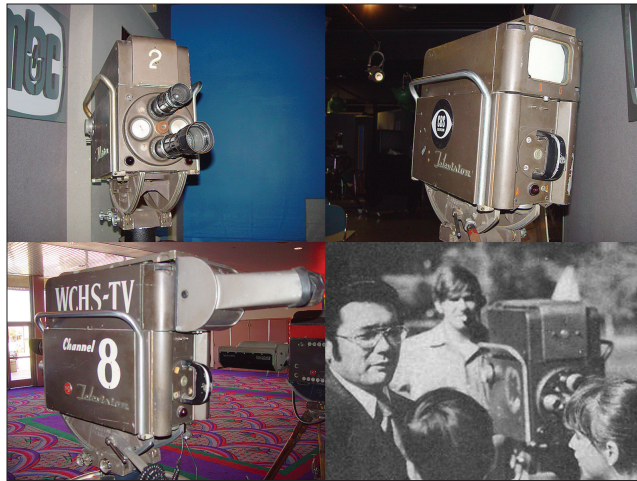


Figure 4.6 The RCA TK-14 black-and-white camera head was the workhorse of the 1950s. Some of its family was still in service on trucks into the early '70s, as the lower photo of Secretary of Transportation Norman Mineta, then mayor of San Jose, taken in the early 1970s demonstrates. Mounted on the front was a rotating turret that could hold four lenses. The turret was rotated from the rear by a handle. The normal complement of lens was 35-, 50-, 90- and 135mm.

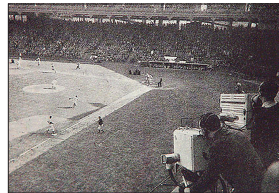


Figure 4.7 Television cameras at a ball game in the mid-40s. While the one on the right had a small electronic viewfinder, the one on the left only had an optical sight.

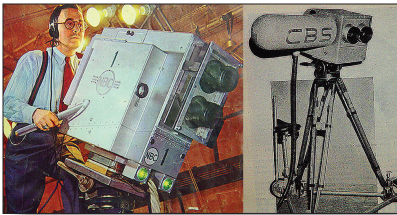


Figure 4.8 Very early experimental color cameras. RCA and CBS had competing color systems for a while. The CBS system involved a rotating mechanical disk to resolve color. The RCA system was completely electronic and eventually won out. But both cameras had two sets of optical paths, one for the luminance and the second for color light gathering.

Nothing About These was Portable

Red Skelton Studios actually had a truck with a hydraulic lift to allow TK-41 cameras to be stored permanently mounted on cradle heads and studio pedestals. Early color cameras required registration and other setup often. Usually this was done when the camera was first powered up after approximately an hour of warm-up, and then usually a second time right before the game, when the outside temperature was rising for day games or dropping for night games. In

1955 NBC did its first colorcast of the World Series. Partly because of their size and weight, early trucks did not carry many cameras. Three were used for the first World Series. In the fifties and sixties, many network baseball games were covered by a maximum of five cameras. Many local baseball games, even well into

the '70s, only used three cameras — usually at high home, first and third. If a fourth camera was added it was at low home or center field. Back then the event was merely covered; that was all that could be done. Today, events are not merely covered, the unfolding story is conveyed. Back then, if a camera had a zoom lens it was either a 10:1 or, at most, a 15:1.

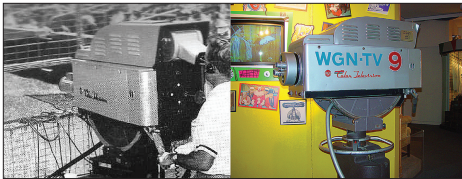


Figure 4.9 In the mid-50s, the color camera found itself out in the field. It made the black-and-white camera seem portable. The first widely used color camera, the RCA TK-41, had three orthicon tubes, and a camera head that weighed a mere 250 lbs. without the viewfinder. The viewfinder added another 45 lbs. The whole camera chain weighed in at nearly 500 lbs. Because early cameras were so heavy, the cradle pan/tilt head (shaped like baby's cradle) was used to distribute the weight of the head over a wider footprint.

Early cameras could be coaxed to work on the road, but to have a number of them working at the same time could be dicey. First-generation color cameras weren't practical on the road, especially in large numbers, as it would take a small army to set them up, due to their weight and unstable nature. Next we will see how advances in imaging technology, and electronics in general, made color television cameras a practical "roadie." ■

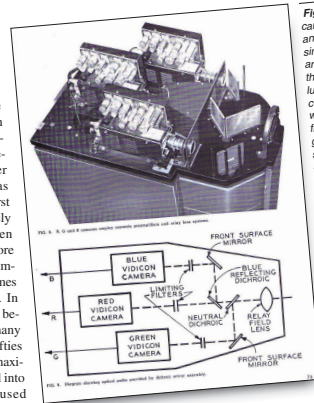


Figure 4.10 The color camera is really three black-and-white cameras in a single case (although there are many four-tube cameras, three for color, one for luminance). Although the color camera shown here with its cover off is really a film chain camera, it graphically shows the three separate cameras and the set of dichroic mirrors up front that creates a prism. These three cameras each looked at one of the primary colors (red, green or blue) as separated by a prism. The three separate cameras, or channels as they are known, would be combined to create the composite color signal by the camera system's encoder. Fitting all three cameras into a single case initially made for very large, heavy cameras.

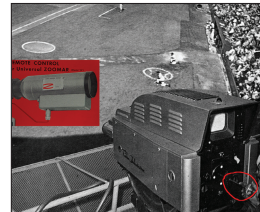


Figure 4.11 A WGN TK-41 at a Cubs game around 1960 using a 10:1 Zommar lens controlled by a "push-rod." Instead of a crank handle to change the zoom setting, a rod running right through the center of the camera head to the lens was used. Many Japanese studio cameras retained this type of zoom until the rollout of CCD cameras, as many Japanese

operators liked this type of control. Circled is the push-rod zoom control handle. You pushed the rod in to zoom in, and rotated it for focus. Inset is the zoom lens, which eventually could be electrically controlled.