



Broadcast Engineering

*the technical journal
of the broadcast-
communications industry*

BROADCAST ENGINEERING ■ JANUARY 1988 ■ REMOTE BROADCASTING



**Remote
broadcasting**

A history of



remote broadcasting

Last year marked the 50th anniversary of the first telecast of the World Series. Historically, this type of activity has been referred to as a "remote." Describing how to conduct remotes is daunting. In this age where camcorders are as pervasive as toasters, the engineering and technical endeavors required to "pull off" a remote are lost on the average viewer. Today, 50-foot trailers with their complement of equipment are the norm. As we begin the next 50 years of remote TV coverage, it's time to look back to where remotes have been and where they are today.

By Jim Boston

The economics of "remote" production has paralleled the airline industry in many ways. People get into these fields because of the perceived glamour. But don't tell that to the people who do the work, fourteen hours a day, often in the rain and cold. On the other hand, if you like to travel and see new things and enjoy the adrenaline rush from the terror that comes from doing live television, this is the business for you.

The ability to improvise, troubleshoot and engineer under environmental and time constraints is extremely helpful. The draw this business has for many means there is no shortage of people building and operating remote facilities. However, there is a high infant-mortality rate for startups, just as historically has been the case for airlines. The equipment, planes in the case of airlines, trucks in the case of the remote companies, often has numerous owners over its lifetime. Also, like with the airlines, we periodically see a consolidation of players and a few heavyweights emerge, with many smaller providers finding a niche or disappearing.

Mostly for sports

Historically, most trucks were built for sports. Trucks have been referred to as "sport" or "show" trucks. The difference is that "show" trucks have larger, more luxurious control room compartments, while "sport" trucks have more VTR capability, mainly for replays. Audio used to be more elaborate in a show truck, but now audio has taken on increased importance in many trucks.

Most trucks came about to cover sporting events, although sometimes a station would build a truck for use on a particular show or to show the station's "colors." With the exception of 16mm film, the only way to acquire video was with an electronic TV camera. Long before news departments discovered that an RCA TK-76 and a Sony VO-3800 could go together to allow a TV crew to go almost anywhere, cameras were not portable. The RCA TK-11 had a camera head that weighed 107 pounds and required a 65-pound "suitcase" camera control unit as well as a 62-pound "suitcase" power supply. It needed a thick multicore camera cable (remember TV-81?) and lots of light (many cameras had their own light mounted on top); and it was only black and white. Its picture was harsh, and the orthicon pickup tube was sticky and burned easily. If the camera operator happened to find the sun, you had to buy a new tube. Often, much time was needed shooting white cards to "de-burn" the tube after use. To try to stop the "burning" of the tube, the cameras had an orbitor, which consisted of a motor mounted to the side of the camera that slowly rotated the position of the yoke and tube to slightly move the image

continually. However, it was noisy and often had to be turned off in close-up situations.

More cameras tell the story

The zoom lens didn't exist until the mid-1950s. The camera had a turret on its front that accepted four common fixed lenses: 35mm, 50mm, 90mm and 135mm lenses. But no director wanted to see a new lens racked when that camera's tally light was on. "Trucking" or "dollying" the camera was the only way to tighten in on a subject without changing the lens. Today, the 70:1 zoom is found on many sports remotes. Where 15 years ago, head-to-toe shots used to be 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 the 70:1 zoom lens.

In the mid-'50s, the color camera found itself in the field. It made the TK-31 seem portable. The RCA TK-41 was the first widely used color camera. It had three orthicon tubes and a camera head that weighed a mere 250 pounds, without the viewfinder, which added another 45 pounds. The whole camera chain weighed almost 500 pounds. Red Skelton Studios had a truck that had a hydraulic lift so cameras permanently mounted on cradle heads and studio pedestals

could be stored permanently "built."

Early color cameras required registration and other setup adjustments often. Sometimes, this procedure had to be repeated a second time right before the game as the outside temperature rose for day games or dropped for night games. In



KSTP-TV took color TV on the road in this fully equipped color cruiser

1955, NBC did its first colorcast of the World Series. Partly because of their size and weight, early trucks did not carry many cameras; the first World Series had three. In the 1950s and '60s, many network baseball games had 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 bases. If a fourth camera was added, it was at low home or center field. Back then, the event was merely covered. If a camera had a zoom lens, it was either a 10:1 or at most a 15:1.

Today, five to seven cameras is common for local baseball games. FOX uses 11 or 12 when it does baseball. High cameras aren't the rage anymore. High home and maybe high first survived, but now low cameras are used. Cameras at low first and third cover right-handed hitters and left-handed pitchers or left-handed hitters and right-handed pitchers. Center field is considered indispensable for pitcher/batter shots. Now, cameras are added from various angles in the outfield. The object today is not to just cover an event, but to tell the story of the game.

A history of remote broadcasting

Camera evolution

In the 1960s, camera evolution accelerated. The second generation of color cameras included TK-42/43s for RCA and PE-250/350s from GE. They tended to use four pickup tubes—three for color and one for luminance. Although their resolution improved, it took the invention of the “enhancer” to improve their sharpness. Although this device was made available separately, it was first included as part of the camera in Norelco's PC-60/70. This was a third generation of color cameras that used three Plumbicon tubes instead of orthicons (or a mixture of orthicon/vidicom tubes).

Within a couple of years, RCA responded with its TK-44. These camera heads were approximately 70 pounds and made remotes easier. ABC and CBS made extensive use of the PC-70. In the late 1970s, RCA introduced the TK-76. Within a few years, it had a hard camera shell that it could be installed into so it could be used as a hard camera. This was known as the TK-760 and NBC made extensive use of it for remotes. The problem

with these cameras was they were still designed to use multicore cable between the camera head and the camera control (although some vendors offered triax systems for the TK76/760).

The next generation of cameras confronted the multicore issue. They also introduced the microprocessor for use as camera controllers. Most camera chains had a microprocessor in the camera head and the camera control unit. These two processors talked to each other over an RS-232 link through the camera cable. The CCU would continually send out a stream of analog values (commonly known as a pulse amplitude modulation [PAM] stream that the head stored in sample-and-hold circuits). These analog values controlled everything from registration and

geometry, to video level and iris settings. The microprocessors at the CCU and the camera head-ends ensured that the PAM stream could not get out of sync and have the wrong values written to the various sample-and-holds. The other architectural approach was to have the camera system reside in the head.

Instead of splitting the video processing between a camera head and the CCU, all the processing was in the head and the CCU was not much more than a remote-control unit. These two approaches made triax feasible. To power the head, AC or DC with a potential of as much as 300V is sent down the center conductor of the triax. Most



WGN-TV covered 120 Cubs and White Sox daytime home baseball games during 1960, with four RCA TK-41 cameras.

cameras have power safety systems so power is only applied if the right load and current draw is sensed. Cameras on multicore could not have runs of more than 1,000 feet (500 feet was a safer length). Today, half a mile is a common maximum distance from truck to camera head. Many stadiums have as much as 30,000 or 40,000 feet of triax permanently installed.

The second major area on trucks today revolves around tape. The videotape recorder didn't exist until the tenth televised World Series. In the early 1960s, Quad VTRs were installed on trucks. These first-generation VTRs weighed as much as 3,000 pounds if equipped to handle color. They consisted of as many as five racks of electronics and tape deck in the form of RCA's

TRT-1B or a console unit and two racks if an Ampex VR-1000. Glenn-Armistead, a production company, had two TRT-1s in a trailer, which were used in taping the Ernie Ford show for NBC on location in the early 1960s.

Tape capability was not common on trucks until the 1970s. The second generation of VTRs in the form of RCA's TR-22 and Ampex's VR-1100/1200 made tape road trips more doable. The VTR fit within one stand-alone box, which was at least six feet long and six feet high and weighed more than 1,000 pounds fully loaded. What was considered fully loaded? Color capability, servos that would gen-lock to external

reference and the ability to do insert or assemble edits were all optional. Some machines were used for early attempts at instant replay. But these Quad (four rotary record/play heads) machines would produce no playback video in still and would not output playback video at any speed other than times one (because of their segmented tracks). The digital TBC and DT/AST head to make variable speed possible would not arrive until the early 1970s. An added plus with these machines is that they were

slow to accelerate tape in shuttle, and if you were lucky, the machine would servo lock after only two seconds.

At the end of the 1960s, Ampex made the era of the instant replay feasible with its HS-100 analog disk recorder. It allowed instant access and playback speeds other than times one. But its storage capability was only a couple of minutes. Its cost ensured that only the networks would be able to use it on a regular basis. Even then, there was normally only one of these units at a venue. Not until the digital TBC gained enough muscle and the AST/DT playback head was invented would instant replay capability become common place.

The arrival of the type C format VTR from Sony and Ampex created the expectation that all trucks have replay

capability. Today, one-inch VTRs have given way to Betacam and digital Betacam. Last year's Super Bowl used 22 VTRs for replays. The replays' central role in telling the story now dictates that many shows must have a producer to coordinate isolation strategies and playback selection from the slew of machines available. Directors and producers have to understand the strategies and tactics of the teams they are covering. For Monday Night Football, ABC uses a separate truck just to house the 14 VTRs it uses for replay duty.

Audio then and now

Audio also saw its importance grow exponentially. Early audio mixers often had no more than a half dozen inputs; today's mixers have as many as 96. In fact, many times the audio effort was small enough that the mixer was not even in the truck. The mixer would be setup up in the announcer's booth for baseball or football coverage. There was little emphasis on capturing the sounds that comprise the composite event experience. Early efforts at this often centered on marrying snow saucers or even wooden salad bowls with stick microphones. These crude parabolic mics were used to capture the "bat crack" sounds in baseball or player contact in football.

On to video switching

The production compartment has to keep pace with the other areas of the remote truck when it comes to change. The change in video switchers has been the continual increase in capability. Not only has the number of effects banks increased, but the functionality of each bank has increased. Past switchers only allowed one operation per effects bank, be it a dissolve, a wipe or a key. The ones in use today allow more than one of those operations to occur simultaneously on each bank. The use of "snapshots" allows the operator to store and recall switcher setup almost instantaneously. In its infancy, there might be half a dozen sources available on a remote. Today, sources have increased to a point where routers are needed to filter the amount of sources available at any instant at the switcher. Switchers now accept dozens of inputs and, in some cases, to keep the

control panel a manageable size, have "shift" functions for crosspoint buttons so that each button can access more sources. Almost every truck now has a DVE/DME onboard; some even have still-stores.

The number of monitors found in the production compartment has exploded. The term "monitor wall" didn't



Tractor and two trailers that comprise the Glenn-Armistead color TV production system. One unit contains control, switching and effects equipment; the other contains a film system and two color TV tape recorders.

exist early on. In fact, monitors used by the director and technical director were often the same ones used by the video operator to shade cameras. Many early trucks had a single compartment. All the operating positions in the truck would use the same set of monitors. Today's trailers usually have separate compartments for camera control, videotape, production and audio. Sometimes, transmission has a separate compartment, but it is usually associated with video.

The final area that has gained prominence on a truck is graphics which didn't exist on trucks until the mid-'70s. Graphics used to be a black-and-white camera, often just outside the truck, that shot art cards. Those graphics weren't keyed over video until the '60s. Early on, switchers could only "super" them. That meant superimposed by doing a partial dissolve to the graphics camera. In the '70s, NBC worried that multicolor graphics might make the scene too busy. Now, bumpers, replays, even regular play, use heavy graphics. FOX NFL coverage uses a separate truck for all the graphics layered over the game. Today, switchers need multiple downstream keying capability to handle all the sources that

end up on the scene simultaneously. The era of the single "Chyron" operator is rapidly coming to a close.

Moving on

Trucks today would probably not recognize their ancestors. Early trucks resembled a bus or a book mobile. The driver could usually walk from the

steering wheel to the back of the unit without going outside. The other truck architecture was the box and cab, much like many Ku trucks today. Unless you were putting tape machines on a vehicle, it was hard to fill up the space in a 40-foot trailer. Few tractor trailers were in use until the '70s. The Glenn-Armistead and the trailer WGN used for White Sox and Cubs baseball in the '60s were only a few examples. WGN's 40-foot trailer only carried four TK-41 cameras.

Today, trailers as long as 53 feet ply the interstates. Many are pushing the 80,000-pound maximum bridge weight limit. Many trailers separate their dual axles by a few feet so they can carry more weight over the trailer's wheels.

The remote business has captivated many of us. It offers what has drawn many of us into this business in the first place, adventure and a taste of show business. With the exception of news, it is the last bastion of live television. ■

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Authors' note: The author wishes to thank Glenn Hill, senior support engineer for production systems, Sony Electronics, San Jose, CA, for his technical support in this article.