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Video I

2" Quad Studio Recording Production History

When 2" quadruplex videotape was invented in the mid 50s, it led to a revolution in the way that television shows were produced and distributed for audiences. As the first major commercial videotape format, it revolutionized the way that television was conceived of. Quadruplex was the first videotape format, presented publicly in 1956 and utilized by the industry for over 25 years. Throughout the years, various elements of the production process of the format were slightly tweaked, improved upon, or merely altered. This paper is an attempt to explore the production processes of the 2" Quadruplex format that studios would have employed in their workflows early in the format's history. It will first provide a brief history of the format to contextualize it in the greater narrative of television broadcast history, and then it will continue with an exploration of workflows using examples from select recordings from the late 50s and early 60s. The discussion will be useful to the greater understanding of archiving and preserving material on this format.

History

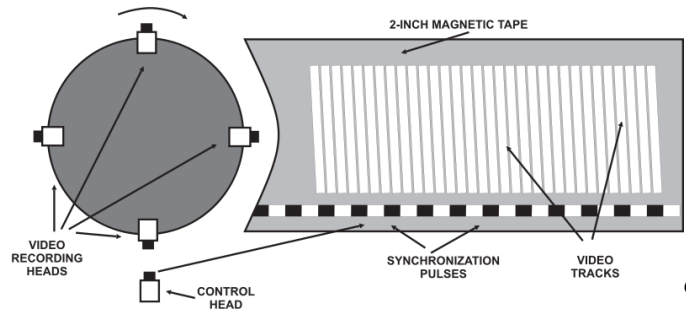
The birth of magnetic recording comes out of the post WWII period when the process of recording information to a magnetically coated tape by passing it across an electromagnet, and then playing it back in the same manner, was discovered in Germany. On April 14, 1956, Ampex Recording Studios made a presentation at the CBS Affiliates meeting in Chicago, demonstrating their new product made to record television programs for networks. At the time, television networks were using kinescopes to record programs broadcast in the Eastern Time Zone so they could replay these programs hours later for the West Coast. Ampex's new product, the first practical videotape recorder (VTR), allowed the networks to record on tape manufactured by 3M. The product was so successful that the following week, Ampex demonstrated it every 15 minutes to patrons of the National Association of Radio and Television Broadcasters convention in Chicago to great success. The orders started coming in from major networks and the VTR was born.

The quadruplex VTR recorded and played back a signal on 2-inch wide tape. It utilized four recording heads, giving it its name, quadruplex, or quad.¹ The quad VTR, early models of which included the Ampex VR1000B and the RCA TRT1A, utilized four rotating heads mounted cylindrically. Tracks on the tape were positioned on a 90 degree angle, or set vertically across the width of the tape. The machines utilized transverse scanning of the tape, a disc with four heads would scan the tape while formed into a U shape. Standards were adopted very early in the development of the Quadruplex format, allowing it to become widely adopted.² These standards conformed to early Ampex specifications. It follows that machines like Ampex and RCA were

¹ Jeff Martin. "The Dawn of Tape: Transmission Device as Preservation Medium". *The Moving Image* - Volume 5, Number 1, Spring 2005, pp. 51-53.

² Koichi Sadashige. "The Effect of the Choice of Tape Format on Broadcast Video Recording". *IEEE Transactions on Broadcasting*. Vol. BC-20, No. 1, March 1974. pp. 12.

interchangeable, as the same tape speeds were utilized in the creation of recordings.³ NTSC Standards dictated that the head rotated at 14,400 revolutions per minute, or 240 revolutions per second.⁴ The tape passed at a speed of 15 inches per second. A control track was recorded along the bottom of the tape, an audio track along the top of the tape, and eventually a cue track was added to the tape to record timecode or other audio information. The two-inch wide tapes were made of pure iron oxide.⁵ A standard 4,800-foot reel held just over an hour of footage.



Production and Editing

In the late 50s and early 60s, television shows were recorded to assist with time switching, and the value of the show itself on tape was in its ability to be shown just a few hours later for new audiences. Compared to the kinescope operation previously employed, the Quad system was more efficient, cheaper, and easier to manage. However, the whole system relied on the ability to erase and reuse the tape stock. Two-inch tapes were incredibly expensive for a few reasons. The first was that the technology was very new, and tape production was slow as it was still being formalized. Second, Ampex and other companies did not anticipate the high demand that would be placed on them immediately following the 1956 presentation of the first working quad VTR. While the tapes themselves were incredibly expensive, the studios made up the cost of the tapes by erasing and reusing them. Very few of the tapes from the first few years of use exist, and almost none from the first two years.⁷ This economic imperative had repercussions for the way television shows were produced and recorded.

In the beginning, quad videotape was edited by physically cutting the tape with a sharp blade and splicing it together in a process similar to film tape splicing. Cuts were initially made randomly and disturbances in the picture were evident due to the momentary loss of the sync pulse. Linear video editing, as this process was called, was done at an adjacent editing bench.⁸ Editors were eventually equipped with a microscope and a solution of iron filings dissolved in a solvent that would be applied to the marked tape for editing, and editors would use their equipment to find the sync pulses on the tape. The tape would be cut at the vertical blanking

³ “Industry Agrees to Standardize Tape Recordings on Ampex Lines”. *Billboard*. Oct 28, 1957. Accessed 10/29/11 at <http://books.google.com/books?id=ICkEAAAAMBAJ&pg=PA3#v=onepage&q&f=false>.

⁴ Tim Stoffel. “Videotape Systems Theory”. Accessed 10/23/11 at <http://www.lionlamb.us/quad/theory.html>.

⁵ John Mallinson. “Magnetic Tape Recording: Archival Considerations.” *IEEE*. 1990

⁶ Image from Wikipedia “Quadruplex”. <http://en.wikipedia.org/wiki/File:Quadruplex.svg>.

⁷ Jeff Martin, 46. For more information on the surviving videotapes see Martin’s specific list in the article.

⁸ For more information on editing see Arthur Schneider’s *Jump Cut!: Memoirs of a Pioneer Television Editor*.

period so the edit would be smooth to the viewer's eye, without loss of the synch pulse. The two pieces would then be spliced together using a thin foil splicing tape. This was a volatile process that often had repercussions that affected the quality of the image, "If you did everything just right and were lucky, the splice would not produce any picture disturbance when played back. If you were very unlucky that day, the splice would fail as it passed through the vacuum guide, and you would break off a video head tip! (A quad head rebuild costs about \$1800!)"⁹ Additionally, in the early 60s, synch pulses were not easy to find and often editing was done in a way that left the tape searching for the new sync pulse post-edit.¹⁰

Engineers worked hard to create an electronic editing system, and by 1963 the editor was able to make more accurate edits. The system allowed editors to put cue tones on the tape's cue audio track. Cue tones could be placed at the points of edit on the tape, and the system's edit mode would detect the cue tones, allowing for smoother electronic edits. "Although early versions of this system required frequent alignment, it worked quite well, and was used on quad machines right up to the end of their production in the early '80's. Some consumer machines use this system today". It was not until the early 1970s that the electronic splicing system was streamlined and became widely used. "In 1972, truly easy electronic editing came to be. IVC corporation produced an easy-to-use editor for their model 900 VTR. It had just six buttons, and anyone could learn to operate it in about ten minutes. This was the beginning of 'point and shoot' or 'punch and crunch' editing found on most professional machines today."¹¹

As explained by Pamela Nash, tapes that had been physically edited were not easily erased and could not be reused. Because of the high cost of tape stock at this time, many programs were shot as though they were live, with very limited editing. In 1959 Al Cantwell, Batten, Barton, Dustine & Osborn's vice president and head of live and tape television production, an agency producing national commercials, says of his workflows, "a few months ago I was firmly convinced that the only way to use tape was in continuous action or live technique... I now feel this way. Stick to live technique as much as possible, since it is here that tape's economic advantage can be best realized". In fact, Robert Herridge, producer of the "Theater" and other television productions for CBS, would plan out and rehearse productions so that "our method is to produce on tape the equivalent of a live television show- that is, a program with a beginning, a middle and an end, and without stop or stop-start techniques"¹².

The Twilight Zone

In the second season of *The Twilight Zone*, six of the season's episodes were filmed using 2" quad tape. The primary goal was to cut production costs. The first episode shot on tape was in November 1960 and the last was in April of 1961. The process involved filming the episodes similar to filming a live production, and the shows were taped at CBS Television City in Los Angeles. Four cameras were utilized and connected to monitors in a booth manned by a technical director. Under the supervision of the director, the technical director switched from one camera to another during the filming. This editing strategy was similar to live television tapings, and most editing was done on the spot, and then recorded to tape without using linear editing

⁹ Tim Stoffel. "Videotape Systems Theory".

¹⁰ "2" Quad". The Pamela Nash Experience. Accessed 10/25/11 at <http://archive.whoniversity.co.uk/tech/index.html>.

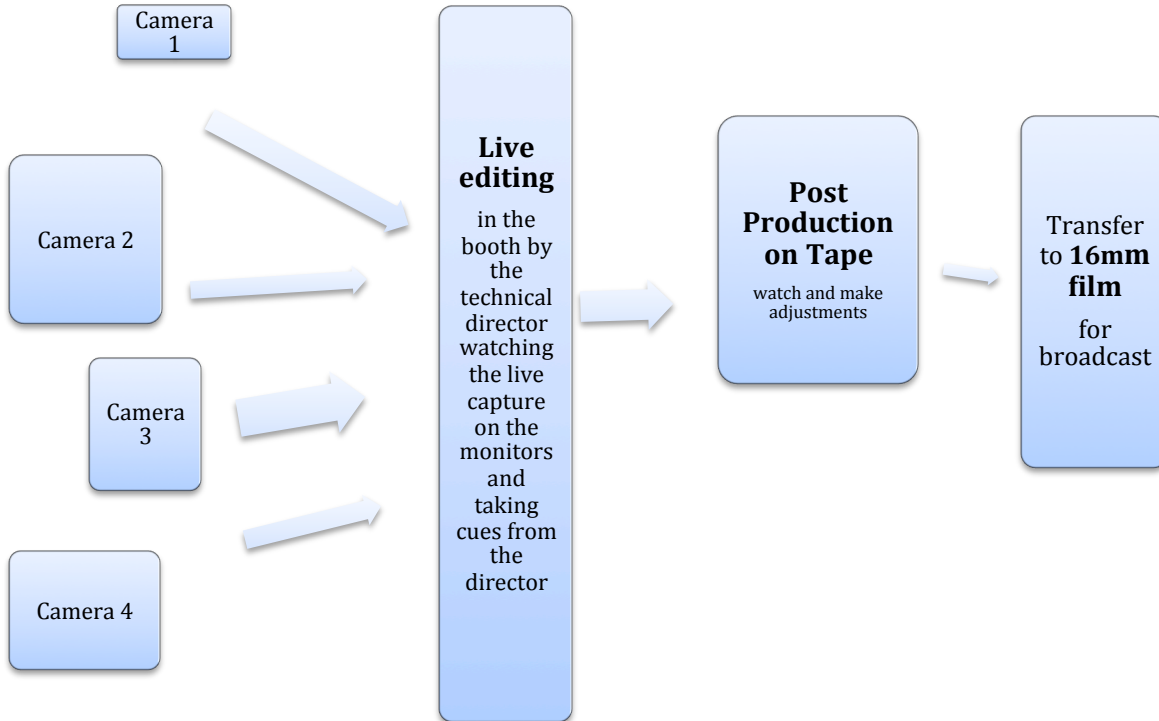
¹¹ Tim Stoffel.

¹² "The Show is On Videotape". *Concepts in Video Tape Recording*. Minnesota Mining and Manufacturing Co. (3M). 1959.

techniques or physical splicing. Because of this setup, more rehearsals and less actual filming time was a part of the overall production schedule.

Filming on tape saved the production, on average, \$5,000 an episode. However, Rod Serling, the creator and main writer for the show, deemed the experience “a disaster” mainly because using tape instead of film to create the show limited the options available to them. Because tape was still very new in its development, and physical splicing made it difficult to reuse tape stock, the shows were bound to the sound stages they filmed on. External locations could not be used, and this was a serious impediment to a show that relied on the whole universe for its gripping and odd story lines. Effectively, the plot’s themselves were limited. Camera movements and setups could not be complex due to the limited nature of recording with tape. Additionally, Serling could only hire directors and crew who were used to working with live tapings, instead of those well versed in film production processes.

The taped shows were eventually transferred to 16mm film for broadcast, and the tapes were erased to be reused in the future. After six episodes were completed as requested by the network, *The Twilight Zone* abandoned using videotape as part of its workflow and went back to film.¹³



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Eventually, tape was used as a broadcast format, without the jump to film. Tapes were even shipped to affiliates, presenting its own challenges. As Martin explores, a document produced by National Education Television and distributed with shipped tapes gave “guidelines for how to handle videotape, it gave tips on proper rewinding, starting and stopping, packing for shipping, and so on”¹⁵.

¹³ Marc Scott Zicree. *The Twilight Zone Companion*. Second Edition. Los Angeles: Silman-James Press, 1989. pp. 194 & 134.

¹⁴ The Twilight Zone production workflow as explained in *The Twilight Zone Companion*.

¹⁵ 58.

Archiving and Preservation Implications

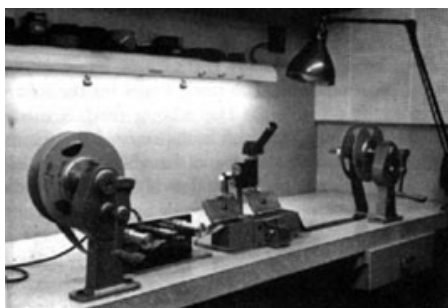
The Quadruplex machine was a large and bulky piece of equipment and required the use of an experienced engineer. Contact between the head and the tape was a key component to get an accurate signal reproduction, and the proper tension was required to maintain correct contact. If the tension was not at an optimal level, the tape could break in the machine.¹⁶ The machine was kept cool with the use of compressed air, with up to 1000 pounds per square inch of pressure exerted on the tape, resulting in magnetic flaking and other issues that could have repercussions for acquiring an accurate reproduction. Because the format was new, tapes made in the 50s and 60s were more fragile than later versions and often would only be able to handle around 100 passes through the machine.¹⁷ Although standards in the speed of the tape were established early on in the field, other concerns could render a tape useless in a machine that did not record it. Early models had heads unique to their machine that were not compatible with other machines. As Jeff Martin states, “If a show had to be held for a long time, say five weeks, when Arthur Godfrey went on vacation, CBS stored the heads with the tapes and hoped for the best.”¹⁸

While quadruplex VTRs used 2” tape as a recording medium, helical scan recording was invented not long after as a broadcasting format and also used 2” tape. However, helical scan machines laid tracks on tape at an angle to the width of the tape. Helical and quadruplex are not interchangeable although they both use 2” tape.¹⁹

The largest concern for the preservation and archiving of material recorded through the quadruplex format is a cultural concern; for a few decades the material held on the tape was considered to be less important than the value of reusing the stock itself, and much of the early material is lost due to this perspective. Material that did survive is at risk of deterioration due to its age, is possibly on stock that has been recorded over a few times, and is housed on an obsolete format that only few technicians are skilled to work with today.



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¹⁶ Sadashige, 14.

¹⁷ More information on specific problems that can occur due to this process, with a visual troubleshooting guide can be found at the Pamela Nash Experince. “2 inch quad”.

¹⁸ Martin, 56.

¹⁹ Sadashige, 12.

²⁰ Photo: The first Quadruplex VTR with the six men responsible for its development. Ampex.

<http://www.lionlamb.us/quad/thesix.jpg>.

²¹ Photo: A linear editing site for the Quadruplex VTR. Accessed 10/29/11 at <http://archive.whoniversity.co.uk/tech/index.html>.