The AmpexEditec:

Early Video Editing

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CINE-GT.2920 Moving Image and Sound: Basic Training

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Ampex, a Redwood City, CA-based electronics company, released the Editec in 1963. The Editec was an add-on to another piece of Ampex equipment, the Electronic Editor. Combined, the two systems provided an electronic means of videotape editing. Before electronic editing, all cuts were made with physical splices. Though conceived for the unique demands of videotape, electronic editing has become the most common method for moving image editing today.

To understand the significance of the Editec, it is helpful to understand early video. Videotape recording emerged in the mid-fiftiesto meet the challenges of the broadcast television environment. Early television transmitted live events and performances. Video cameras captured images as "a series of changing electrical modulations"[1] which could then be broadcast wirelessly as radio waves. Television sets with cathode ray tubes received the electrical signals and translated them back into visual images.This process did not include a mechanism to record images for later use. This prevented broadcasters from being able to save programs for rebroadcasting.

Television networks first attempted to record their programs by means of kinescope recordings. Julia and Michael Stanton, in a historical account of video recording for SMPTE, describe the process:

> Not fully perfected until 1948, the kinescope… was basically a film, exposed in a motion-picture camera pointed at a special high-resolution television monitor. The kinescope recordings were generally of low quality and subject to image degradation because of the film stock used. However, the filmed recordings could be stored, reused, and edited.[2]

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[1]Enticknap, Leo. *Moving Image Technology from Zoetrope to Digital*. Great Britain: Wallflower Press, 2005, 160.

[2]Stanton, Julia A. and Michael J. Stanton. "Video Recording: A History." *Journal of the Society of Motion Picture and Television Engineers* 96, no. 3 (March, 1987): 253-263, 253.

The kinescope was rendered obsolete by the advent of videotape recorders. Videotape provided a storage medium for the electrical signals, which magnetize the metal oxides bound to the tape.[3]

Ampex created some of the earliest videotape recorders (VTRs). After several prototypes, Ampex released the quadruplex VR1000 for sale in 1956.[4]Videotape offered many advantages for the broadcast environment compared to the film kinescope. Julia and Michael Stantondescribe the advantagesof videotape recording: "Quadruplex recording systems, taking their name from the four-head assembly, brought television into its own. Instantaneous recording on tape was now possible. Playback required no time delay for developing the image as with film. Tape could also bereused again and again with little orno signal deterioration."[5]Videotape was better suited than film to the fast-paced production environment of television, which produced new content daily. However, videotape was significantly more difficult to edit than film. This limited the narrative options available to television producers.

Like film, early videotape editing involved physical splicing. Videotape could be cut and reattached with adhesive tape. However, unlike film, the images recorded on videotape are not visible. In a reel of film, each frame is visible as a miniature photographic image. The appearance of videotape does not change throughout a reel; it merely looks black. In order to make the content of videotape visible, editors used Edivue

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[3] Weise, Marcus and Diana Weynand. *How Video Works: From Analog to High Definition*. 2nd ed. United States of America: Focal Press, 2007, 188.

[4] "Ampex Quad Catalog " http://www.lionlamb.us/quad/ampex.html (accessed 10/14/2015, 2015). ;Mishkind, Barry. "Ampex Equipment Archive " http://www.oldradio.com/archives/hardware/TV/Ampex/VR1000.htm (accessed 10/14/2015, 2015).

[5] Stanton, Julia A. and Michael J. Stanton. "Video Recording: A History." *Journal of the Society of Motion Picture and Television Engineers* 96, no. 3 (March, 1987): 253-263, 255.

Diluent developer.[6] This revealed the magnetic pattern on the tape, which manifested as a series of vertical bars. Each splice had to be made at a specific point on the tape, the vertical blanking period, or it would disrupt the image and sound.[7]In video, vertical blanking is "the period of time in which the electron beam is turned off while it moves from the bottom of the image to the top of the image to begin tracing or scanning the next field of video."[8] With the electron beam turned off, cuts would not be read. The Smith Splicer helped editors locate the vertical blanking period for a splice. It was comprised of a block, guillotine knife, and microscope. The block held the tape in position. Through the microscope, the developed magnetic pattern could be seen. The editor would look for the edit pulse mark, which showed where to make the cut. The editor would align this mark to just after the guillotine cutter and bring down the blade. The videotape could then be joined to a different piece with 3M Scotch Brand Aluminized Video splicing tape.[9]

Video editor Arthur Schneider described the difficulty of cutting videotape in an article for SMPTE.

> Because the sound pull-up must be taken into account during physical tape editing, some people found it difficult to deal with. Videotape uses a 19-frame sound advance with respect to picture. All marking and cueing of edit points were done "on the fly." By the snap of his fingers, the director made his edit decisions. The editor had to stop the tape machine, taking into account his reaction time and the slowing down of the VTR before stopping. Then he had to make the approximate spot on the back side of the tape where he wanted to make the cut. It was mostly trial and error and, compared to today's standards, was very crude and risky.[10]

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[6]"Smith Splicer " http://www.vtoldboys.com/editingmuseum/smith.htm (accessed 10/14/2015, 2015).

[7] "Museum of Early Editing Equipment and Techniques " http://www.vtoldboys.com/editingmuseum/ (accessed 10/14/2015, 2015). ; "2" Quad Tape." http://www.millenniumeffect.co.uk/video/tech/index2.html (accessed 11/9/2015, 2015).

[8] Weise, Marcus and Diana Weynand. *How Video Works: From Analog to High Definition*. 2nd ed. United States of America: Focal Press, 2007, 289.

[9]"Smith Splicer " http://www.vtoldboys.com/editingmuseum/smith.htm (accessed 10/14/2015, 2015).

[10]Schneider, Arthur. "Television Post Production – the Small End of the Funnel." *Journal of the Society of Motion Picture and Television Engineers* 87, no. 8 (August, 1978): 512-515, 512.

As a result of the difficulty of making splices, television programs were "shot in big chunks and pretty much in sequence. Physical splicing of tape was limited to pull-ups, inserting commercials, and other simple edits."[11] This prevented videotape from reaching the creative possibilities of film.

For its initial attempt at creating an electronic editing system, Ampex introduced the Electronic Editor. The Electronic Editor controls had a dial that could be set to one of three settings: insert, assemble, or normal. "Insert" was used for placing scenes in the middle of a tape. "Assemble" allowed an editor to compile a tape master by recording tape segments one after the other. The Electronic Editor had to be switched to normal when the VTR to which it was attached was not in use for editing.[12] The editor initiated recording by pressing the record button on the VTR.[13]

The Electronic Editor automatically made splices before the vertical sync pulses[14], preventing the visual disruptions common in physical splicing. However, locating a precise frame was still difficult. Xen Scott, a former video editor, explains that a video editor had "to anticipate the edit by his reaction time plus the 19 frames required to sequence on the erase head, video record heads and finally the audio heads."[15] Mistakes were hard to fix and could ruin expensive tapes. The online "Museum of Early Video Editing Equipment and Techniques" jokingly refers to the Electronic Editor as "Punch and Pray," noting, "The operator had to press the Record button exactly 1/2-second before the edit was to take place. The smallest mistake and the edit would be in the wrong

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[11]Ibid.
[12]Ampex Corporation. . Introduction to Electronic Editing: Ampex, 1962, 2.
[13]Ampex Corporation. . Mark II/ Mark III Electronic Editors. USA: Ampex Corporation, 2.
[14]Ampex Corporation. . Introduction to Electronic Editing: Ampex, 1962, 3.
[15]Mishkind, Barry. "Ampex Equipment Archive "
     http://www.oldradio.com/archives/hardware/TV/Ampex/VR1000.htm (accessed 10/14/2015, 2015).

spot, and worse, there was really no way to correct it!"[16] This degree of chance made the

Electronic Editor difficult to use for very precise edits.Ampex created the Editec to

improve the functionality of the Electronic Editor.

The ability to add the Editec to the Electronic Editor reflected Ampex's modular

design strategy. Though newequipment models were released periodically, upgrades

could be purchased for older machines.[17]XenScott, recalls,

> Most machines I had experience with had field upgrades of one sort or another. It
> was just a matter of how much money one wanted to spend on upgrading an old
> design as opposed to buying a new machine from Ampex, configured the way you
> wanted. Occasionally delivery times were a factor. It could be quicker and
> cheaper to install an upgrade rather than wait for the delivery of a new machine.[18]

The Editec and Electronic Editor were sold separately. In June 1963, the Editec was

announced in the "New Products" section of the Journal of the Society of Motion Picture

and Television Engineers. The price was listed as $9,500, in addition to $3,850 for the

Electronic Editor.[19]

The Editecincreased the amount of control an editor had over the Electronic

Editor. It marked the location of potential edits by recording tones in the videotape's

second audio track.[20] This allowed the editor to cue tapes and watch what an edit would

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[16]"Museum of Early Editing Equipment and Techniques " http://www.vtoldboys.com/editingmuseum/
    (accessed 10/14/2015, 2015).
[17] "Ampex Quad Catalog " http://www.lionlamb.us/quad/ampex.html (accessed 10/14/2015, 2015).
    ;Mishkind, Barry. "Ampex Equipment Archive "
    http://www.oldradio.com/archives/hardware/TV/Ampex/VR1000.htm (accessed 10/14/2015, 2015).
[18]Mishkind, Barry. "Ampex Equipment Archive "
    http://www.oldradio.com/archives/hardware/TV/Ampex/VR1000.htm (accessed 10/14/2015, 2015).
[19] "New Products (and Developments)." *Journal of the Society of Motion Picture and Television Engineers*
    72, no. 6 (June, 1963): 521-527, 527.
[20]Dahlin, Ellis K. "Standardization for Time and Control Code for Video Tape and Audio Recorders."
    Journal of the SMPTE 79, no. 12 (1970): 1086-1088, 1086.

look like before recording to the master tape.[21]A brochure for the Editec, produced by

Ampex, described its operation:

> The Mark I Editec system operates by placing marker tone bursts on the cue track
> of the VTR– and using these markers to electronically gate the recording and
> monitoring circuits. Rehearsal facilities are made possible by gating the monitor
> circuits and leaving the recording circuits unactivated. Control and logic circuitry
> are housed in a 5 ¼" chassis. This chassis is referred to as the Program Unit and
> forms the heart of the Editec system. VTR monitoring, recording, erase and servo
> circuits are electronically switched by the Mark I Editec system.[22]

Cues for the Mark I Editec were recorded at 4.5kHz, the Mark II at 4kHz.[23]The Editec

had several times more controls than the Electronic Editor.The control panel for the Mark

I Editec included a mode selector, cue button, edit/animate switch, remote cue, function

switch, cue select/record frame dial, and a cue erase warning light.[24]The controls varied

across models. The Mark II Editec had fewer controls than the Mark I: mode selector,

start cue adjust, stop cue adjust, cue, pulse, inhibit and erase.[25]Based on their brochures,

it appears that the Mark I Editec was geared more towards animation and the Mark II

towards adding commercials.[26]

A potential issue with editing videotape is the creation of time base errors. For

this reason, Ampex recommended another of its products, the Amtec Compensator.[27]

Although their brochure for the Mark I Editec said that the Amtec Compensator was not

necessary, the specifications indicated that "…the ingoing and outgoing splice time-base

errors will normally be within the corrector range of the Amtec compensator," suggesting

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[21]"Museum of Early Editing Equipment and Techniques " http://www.vtoldboys.com/editingmuseum/
     (accessed 10/14/2015, 2015).
[22]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation.
[23]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation, 2. ; Ampex Corporation.. *Mark
     II Editec* System*. USA: Ampex Corporation, 2.
[24]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation, 2.
[25]Ampex Corporation. . *Mark II Editec* System*. USA: Ampex Corporation, 2.
[26]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation, 2. ; Ampex Corporation.. *Mark
     II Editec* System*. USA: Ampex Corporation, 2.
[27]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation, 1.

that its addition was expected.[28] According to its brochure, "AMTEC accomplishes line-by-line compensation of timing errors in the composite video signal by sampling the timing accuracy of the signal once each horizontal interval, with respect to a stable timing reference."[29] This improved the stability of the edited tape.

VTRs and their accessories were very expensive in the early days of video.The combined price for theEditec and Electronic Editor in 1963 was $13,350. In today's dollars, that would be over $100,000.[30] Large organizations, like broadcast networks and the military, were the first users of the Editec and quadruplex VTRs. Evidence of the Army's Editec use can be found in aphotographposted by Xen Scott.[31]He mentions working with VR-1000C modified with an Editec while working with the Army at Redstone Arsenal, Alabama in 1966.[32]However, he notes that it was somewhat unusual for an Army VTR to have field modifications like the Editec, which he describes as "the full blown videotape animation accessory."[33]Editecs were also used by regional affiliates of the major broadcasting companies. The SMPTE Atlanta Section mentioned watching an Editec VTR at WAII-TV, the Atlanta ABC affiliate.[34]

A known, early use of the Editec was for the television program, *Science in Action*. An episode entitled "Global Television" featured Joseph Roizen, an Ampex consultant, demonstrating the Editec.[35] During a segment on the Editec,

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[28]Ibid, 2.

[29]Ampex Corporation. . *Amtec* Time Element Compensator*. USA: Ampex Corporation.

[30] "CPI Inflation Calculator " http://data.bls.gov/cgi-bin/cpicalc.pl?cost1=13350&year1=1963&year2=2015 (accessed 11/9/2015, 2015).

[31]Mishkind, Barry. "Ampex Equipment Archive " http://www.oldradio.com/archives/hardware/TV/Ampex/VR1000.htm (accessed 10/14/2015, 2015).

[32]Ibid.

[33]Ibid.

[34] "Section Meetings." *Journal of the SMPTE* 76, no. 12 (1967): 1260-1262, 1260.

[35]Science in Action. "Global Television." Youtube video, 21:13. April 2, 1964. https://www.youtube.com/watch?v=vrz-XakUqJE.

RoizencreditsNorman Bounsall with developing the editor. He says that Bounsall is in the other room, editing as they speak "justto prove [the Editec] works."The main use environment for the Editec was indoors, in offices with a VTR and racks of accessories added to it.

Though the Editec was capable of a wide variety of editing functions, it was particularly known for its use in commercials and animation. Using the insert function, new commercials could be recorded over old ones. Ampexstressed this feature in its advertising brochures forboth Mark I and the Mark II Editec, proclaiming, "Commercials can be replaced within their precise, original time period."[36] The ability to replace commercials without risking the surrounding content had obvious economic value for broadcasters. It allowed them to seek out new sponsors for second-run programs, use new spots created by their clients, and replace client ads if business relationships changed.

The Editec's ability to create splices separated only by a frame allowed animators to use video rather than film.[37]Animators could set the Editec to "automatically record any preselected number of frames on the end of a previous recording."[38] The SMPTE Progress Committee Report for 1963positively described a demonstration by Ampex and NBC of the Editec's animation abilities, "Frame-by-frame animation of figure pop-ins, word formations, and a broad range of animation effects, previously possible only with film, were demonstrated on tape. Frame-by-frame cell animation of cartoon characters, heretofore thought impossible on television tape, was also demonstrated."[39] The Editec's

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[36]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation, 1. ; Ampex Corporation.. *Mark II Editec* System*. USA: Ampex Corporation, 1.

[37]Ampex Corporation. . *Mark I Editec* System*. USA: Ampex Corporation, 1.

[38] Ibid.

[39] Putman, Richard E. "Progress Committee Report for 1963." *Journal of the Society of Motion Picture and Television Engineers* 73, no. 5 (1964): 369-410, 378.

animation features kept the system in limited use even after newer editors with time code were introduced. As late as 1984, Unitel Video Services, a television post-production company, had an editing room equipped with Editecs. In a description of their facilities, they wrote, "For several years, Unitel has planned to rebuild the first editing room, but for certain applications, a manual editing system is much more efficient than a computer-assisted system. Specifically, animatics and photomatics are well-suited to the Editec editing room…"[40]Unitel used the Editec over twenty years after its first release.

One of the main advantages to the Editec was its precision. The brochure for the Mark I boasts that "'Beginning" and "end" of scenes can be precisely located, adjusted and previewed (on a frame-by-frame basis) before being recorded on master tape."[41] The ability to set edits to specific frames gave editors the amount of control they were used to in film editing. It eliminated the risk of mistiming activation of the Electronic Editor and leaving a gap on the tape or recording over needed material. Frame-by-frame control was also supplemented by the ability to preview sequences by cueing the edits without recording. Editors could compare edits to find the most effective sequence. Editors did not have to worry about damaging the tape and losing signal to bad edits. According to Arthur Schneider's account of television post-production in SMPTE, "With this electronic "transfer editing," it first became possible to transfer scenes from one tape to another with frame accuracy… Although crude by today's standards, Editec provided a means of editing tape that all but eliminated costly errors because it was no longer

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[40] Dunn, Ted. "Evolution of a Television Post-Production Facility." *Journal of the Society of Motion Picture and Television Engineers* 93, no. 3 (March, 1984): 247-252, 252.
[41]Ampex Corporation. . *Mark I Editec* System*. USA: AmpexCorportation.

necessary to physically cut the tape."[42] Upon the release of the Editec, the SMPTE

Progress committee wrote, "In operation, the Editec system and Electronic Editor

transform the television tape recorder into a production tool capable of any editing

function at costs much lower than with film."[43] Without the reliability introduced by the

Editec, video editing could not have rivaled film editing. Video producers saved time and

money by not developing film.

Despite the Editec's improvements over physical splicing and the Electronic

Editor, it was still a challenging tool to master. The Museum of Early Video Editing

Equipment and Techniques described it as, "an engineer's delight. Lots of knobs and

switches, but in a complex edit session, using it was labor intensive..."[44] Part of the

difficulty of the Editec was syncing the source VTR with the master VTR. R. van der

Leeden wrote in SMPTE, "Even with [the Editec] a great deal of skill is required on the

part of the operator, in adjusting both the playback and recording television tape-

machines in such a way that they both reach the wanted position at the same instant."[45]

An editor had to play through the source footage to find the sections to record to the

master tape.

Although electronic transfer editing eventually became the norm for videotape,

some still looked nostalgically to film editing. In 1967, several years after the release of

the Editec, Jay Johnson,in the Journal of SMPTE, argued in favor of the VTC Film-Tape

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[42] Schneider, Arthur. "Television Post Production – the Small End of the Funnel." *Journal of the Society of Motion Picture and Television Engineers* 87, no. 8 (August, 1978): 512-515, 513.

[43] Putman, Richard E. "Progress Committee Report for 1963." *Journal of the Society of Motion Picture and Television Engineers* 73, no. 5 (1964): 369-410, 377.

[44]"Museum of Early Editing Equipment and Techniques " http://www.vtoldboys.com/editingmuseum/ (accessed 10/14/2015, 2015).

[45]van der Leeden, R. "A Standardised Time-and-Control Code for 625-Line/50-Field Television Tape-Recordings." *Journal of the SMPTE* 82, no. 6 (1973): 482-491, 482.

Translator system.[46] The VTC Film-Tape Translator combined the old kinetoscope recordings with an EDICOMP electronic editor. The studio would recorded a vocal time track on the videotape's cue track.A matching time track would also be recorded in the optical sound area of the kinetoscope. The two were synced with a tone burst. The videotape, along with the matching kinetoscope, was given to an editor. The editor would edit the 16mm kinetoscope film and mark the edit locations. By taking extensive notes and using an MSF Counter (which keeps track of minutes, seconds, and television frames), the editor could translate film edit locations to the corresponding videotape locations. The videotape was then edited electronically. Johnson contended that, with the VTC Film-Tape Translator, "The electronic editing time is sometimes reduced by as much as 70%. Because film editing costs $15.00 to $20.00/hr and electronic editing $225.00/hr, substantial savings are realized."[47] However, this method removed one of the main advantages of video editing: not having to wait for the development of film. I did not find evidence that this system was every widely implemented. Ultimately, greater efficiency in electronic video editing came from the introduction of electronic time code.

Electronic time code was influenced by mechanical tape timers.[48] Mechanical tape timers were used in notating the locations of scenes on a reel of tape. However, the tape timer's measurements could only be accessed while in the machine.[49] Electronic time code was recorded directly onto the videotape and could be read by electronic

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[46] Johnson, Jay. "VTC Film-Tape Translation System of Video-Tape Editing." *Journal of the SMPTE* 76, no. 11 (1967): 1098-1101, 1098.

[47]Ibid., 1100.

[48]van der Leeden, R. "A Standardised Time-and-Control Code for 625-Line/50-Field Television Tape-Recordings." *Journal of the SMPTE* 82, no. 6 (1973): 482-491, 484.

[49]Ibid.

editors programmed to recognize it. Editors could search for specific scenes by a time location. With electronic time code, according to R. van der Leeden,

> There is no longer any need to adjust the machines manually to the right positions before rehearsals of the editing and the accomplishing of it. The time code may be recovered from the tape cue-track at speeds ranging from very slowly up to about thirty times normal play speed in either forward of reverse directions.[50]

Several companies developed editors that used electronic time code. One of the first was EECO, the Electronic Engineering Company of California.[51] Their proprietary time code system was called "On-Time" time code; the EECO-900 electronic editor could read it.[52]In 1969, Ampex also released a time code-based electronic editor, the Ampex RA-4000.[53]It was a "random access tape controller which… automaticallypermit[ted] synchronized search, cue and playback of one or more broadcast videotape recorders."[54]The ability to search by time code allowed frames and sequences to be found much more quickly than with an Editec.

While some considered trying to combine the Editec tone bursts with time code, the two systems were not easily compatible. At an SMPTE panel discussion on video editing, an Ampex representative mentioned the potential for interference when editing tape with codes on and Editec, saying "...in my experience with some of the code harmonics, particularly with the fourth, there is the possibility that some of the Editec tone sensors will respond to the code itself, and this tends to confuse the device."[55]While

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[50]Ibid, 483.

[51]"Museum of Early Editing Equipment and Techniques " http://www.vtoldboys.com/editingmuseum/ (accessed 10/14/2015, 2015).

[52] Ibid.

[53] Ibid.

[54]Ampex Corporation. . *Ampex Fact Book 1970*, Edited by Jay McKnight, 1970, 72.

[55]Remley, Jr, F.M. "Panel Discussion on Videotape Editing." *Journal of the Society of Motion Picture and Television Engineers* 79, no. 3 (1970): 208-215, 209.

the Editec did not disappear as soon as time code editors were introduced, time-code ultimately won out. It is still in use today.

The change from physical splicing of videotape to electronic editing with the Editec has several implications for videotape preservation. On the one hand, not cutting the tape helps slow its deterioration. With transfer editing, the source tapes can be left with their original content intact. This is helpful in a preservation environment where source materials are valued alongside finished works. On the other hand, insert editing recorded over content. If this material were not kept on the original source tape, erasing it from the master would lead to its permanent disappearance. Many broadcasting companies saved money on videotape by erasing and reusing it.[56]Ultimately, the effect of the Editec on preservation depended on the user's workflow.

The introduction of the AmpexEditec was a pivotal moment in the history of videotape. For the first time, video editing could be approached with a flexibility close to that of film. The capabilities the Editec introduced to electronic editing, like animation, allowed television producers to create content that would have been impossible or difficult without it. However, the most significant impact of the Editec is its role as the popularizer of electronic editing. Today's computer editing software,like Avid or Final Cut Pro, have more in common with the Editec than with a Steenbeck. The Editec influenced how we approach editing in many types of visual media, from television to feature films to digital content.

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[56] Lindner, Jim. "The Loss of Early Video Recordings: The Nixon-Khrushchev "Kitchen Debate"." *Abbey Newsletter* 21, no. 7 (: November 11, 2015, http://cool.conservation-us.org/byorg/abbey/an/an21/an21-7/an21-708.html (accessed 11/11/2015).

Bibliography

"2" Quad Tape." http://www.millenniumeffect.co.uk/video/tech/index2.html (accessed 11/9/2015, 2015).

   This page is from a Doctor Who fan site. However, it has some helpful images of bad videotape splices.

"Advance Program." *Journal of the Society of Motion Picture and Television Engineers*71, no. 9 (1962): 682-693.

   This is a program for an SMPTE convention. It lists a demonstration of the Editec by Norman Bounsall and some of the capabilities of the system.

"Ampex " http://www.vtoldboys.com/editingmuseum/ampex.htm (accessed 10/14/2015, 2015).

   This page describes several Ampex editors.

"Ampex Quad Catalog " http://www.lionlamb.us/quad/ampex.html (accessed 10/14/2015, 2015).

   This page was helpful for providing descriptions of different Ampex VTRs.

"CPI Inflation Calculator " http://data.bls.gov/cgi-bin/cpicalc.pl?cost1=13350&year1=1963&year2=2015 (accessed 11/9/2015, 2015).

   I used this tool to calculate what the cost of the Editec would be in today's dollars.

"H2g2 - the History of Magnetic Recording - Edited Entry " http://h2g2.com/edited_entry/A3224936 (accessed 10/14/2015, 2015).

I read this page in the early stages of my research; it helped orient me in video history but did not provide much information beyond some of the other sources I found. It is not a very scholarly source. It is similar to Wikipedia.

"Mechanical TV: How it Works " http://www.earlytelevision.org/mechanical_tv.html (accessed 11/7/2015, 2015).

I looked at this page to get more understanding of how television works, which helped me understand videotape.

"Museum of Early Editing Equipment and Techniques " http://www.vtoldboys.com/editingmuseum/ (accessed 10/14/2015, 2015).

This source was very helpful to me because it gives a rough chronology of several video editing techniques with their advantages and disadvantages. One limitation of the source is that the "curator" is unknown.

"New Products (and Developments)." *Journal of the Society of Motion Picture and Television Engineers* 72, no. 6 (June, 1963): 521-527.

This article is the official announcement of the Editec in the "New Products (and Developments) section of SMPTE. It lists the price.

"Section Meetings." *Journal of the Society of Motion Picture and Television Engineers* 76, no. 12 (1967): 1260-1262.

Mentions a video of the Editec that was shown at ABC's Atlanta affiliate. This suggested that the Editec was in use at regional offices of the major broadcasting companies.

"Section Reports." *Journal of the Society of Motion Picture and Television Engineers* 72, no. 5 (1963): 444-450.

This SMPTE Section Report refers to an Editec presentation in Detroit.

"Smith Splicer " http://www.vtoldboys.com/editingmuseum/smith.htm (accessed 10/14/2015, 2015).

This page, also from the "Museum of Early Editing Equipment and Techniques," goes into detail on how the Smith Splicer was used. It also mentions the difficulty of the technique.

Ampex Corporation. . *Ampex Fact Book 1970*, Edited by Jay McKnight, 1970.

This was an Ampex publication designed to celebrate the company. It features a chronology of some of their inventions. The PDF is not a scan of the original *Fact Book*, it was retyped by a professor.

———. . *Amtec* Time Element Compensator*. USA: Ampex Corporation.

This a brochure released by Ampex to promote the Amtec Compensator. It provides some specifications and explanation of how the compensator works. It is accessible through a link from http://digitrakcom.com/AmpexLit.html.

———. . *Introduction to Electronic Editing*: Ampex Corporation, 1962.

This eight-page brochure provides a lot of detail on the workings of the Electronic Editor.It is accessible through a link from http://digitrakcom.com/AmpexLit.html.

———. . *Mark I Editec* System*. USA: Ampex Corporation.

This brochure gives an idea of how the Editec was marketed. The Mark I discusses animation and some specifications for the Editec. It is accessible through a link from http://digitrakcom.com/AmpexLit.html.

———. . *Mark II Editec* System*. USA: Ampex Corporation.

This brochure suggests that the Mark II is different from the Mark I. It does not mention animation, but heavily references the ability of the Editec to insert commercials. It is accessible through a link from http://digitrakcom.com/AmpexLit.html.

———. . *Mark II/ Mark III Electronic Editors*. USA: Ampex Corporation.

This brochure provides some information on later models of the Electronic Editor. It is accessible through a link from http://digitrakcom.com/AmpexLit.html.

Ampex Data Systems."Ampex History." http://www.ampex.com/l-history.html (accessed 10/14, 2015).

This is an Ampex timeline presented on their business website.

Caldwell, John T. "The Museum of Broadcast Communications - Encyclopedia of Television - Video Editing " http://www.museum.tv/eotv/videoediting.htm (accessed 10/14/2015, 2015).

Briefly mentions the Editec and some of its advantages over earlier editing methods. Also discusses later developments in editing.

Dahlin, Ellis K. "Standardization for Time and Control Code for Video Tape and Audio Recorders." *Journal of the SMPTE* 79, no. 12 (1970): 1086-1088.

Mentions where the Editec tone cues were recorded on the tape, as well as the Editec's ability to rehearse cues.

Dunn, Ted. "Evolution of a Television Post-Production Facility." *Journal of the Society of Motion Picture and Television Engineers* 93, no. 3 (March, 1984): 247-252.

This SMPTE article is a description of the different editing rooms at Unitel Video Services. It provides evidence that the Editec remained in limited use after the introduction of time code-based editors.

Enticknap, Leo. *Moving Image Technology from Zoetrope to Digital*. Great Britain: Wallflower Press, 2005.

A course book I used for reference on early television and videotape history.

Johnson, Jay. "VTC Film-Tape Translation System of Video-Tape Editing." *Journal of the SMPTE* 76, no. 11 (1967): 1098-1101.

Lindner, Jim. "The Loss of Early Video Recordings: The Nixon-Khrushchev "Kitchen Debate"." *Abbey Newsletter* 21, no. 7 (: November 11, 2015, http://cool.conservation-us.org/byorg/abbey/an/an21/an21-7/an21-708.html (accessed 11/11/2015).

This source was a reference for the preservation implications of early videotape. It discusses the destruction of assets through the rerecording of videotape. Jim Lindner is a video preservation expert.

Mishkind, Barry. "Ampex Equipment Archive " http://www.oldradio.com/archives/hardware/TV/Ampex/VR1000.htm (accessed 10/14/2015, 2015).

This site featured descriptions by a former video editor the Editec. He mentions using it at an Army base.

Nulph, Robert G. Edit Suite: Once upon a Time: The History of Videotape Editing. *Videomaker Magazine,* July 1997, 1997.

This article briefly discusses the Editec for its role in the history of videotape editing. It also discusses transfer editing. It is accessible here: http://www.videomaker.com/article/2896-edit-suite-once-upon-a-time-the-history-of-videotape-editing.

Putman, Richard E. "Progress Committee Report for 1963." *Journal of the Society of Motion Picture and Television Engineers* 73, no. 5 (1964): 369-410.

This report from SMPTE features a positive evaluation of the Editec, suggesting that it was seen as an important development from the beginning of its release. The article especially mentions the new animation features of the Editec, comparing them to the abilities of film editing.

———. "Progress Committee Report for 1967." *Journal of the Society of Motion Picture and Television Engineers*77, no. 5 (1968): 481-532.

Mentions the introduction of the Mark II Editec. Has a photograph of the control panel.

Remley, Jr, F.M. "Panel Discussion on Videotape Editing." *Journal of the Society of Motion Picture and Television Engineers* 79, no. 3 (1970): 208-215.

This panel focused on the issues surrounding early time codes for videotape.

Schneider, Arthur. "Television Post Production – the Small End of the Funnel." *Journal of the Society of Motion Picture and Television Engineers* 87, no. 8 (August, 1978): 512-515.

This essay for SMPTE discusses the history of videotape editing up to the late seventies. It credits the Editec with introducing "transfer editing" and mentions some of the Editec's capabilities.

Science in Action.. *Global Television*. San Francisco: California Academy of Science, 1964.

This is a television episode that features a demonstration of the Editec. The Editec is promoted as an important development in television. The Editec's speed and simplicity is promoted, arguably in excess of reality. It demonstrates time-lapse editing.

Stanton, Julia A. and Michael J. Stanton. "Video Recording: A History." *Journal of the Society of Motion Picture and Television Engineers* 96, no. 3 (March, 1987): 253-263.

I used this essay on video recording primarily for information earlier techniques like the kinescope.

van der Leeden, R. "A Standardised Time-and-Control Code for 625-Line/50-Field Television Tape-Recordings." *Journal of the Society of Motion Picture and Television Engineers*82, no. 6 (1973): 482-491.

Though mostly about time and control code, this essay mentions the skill needed by a user of the Editec.

Weise, Marcus and Diana Weynand. *How Video Works: From Analog to High Definition.* 2nd ed. United States of America: Focal Press, 2007.

    I used this book as a reference for video. I quoted its definition of the vertical blanking period.