

Format History — 1/2” EIAJ open reel video

Rather than being an entirely new format realizing a specific new technological capability or means of embodying images, half-inch (1/2”) EIAJ was a standardization scheme for already established video recording technology using 1/2” wide tape. Although video tape recorders were first made available to the public in the mid-1960s, individual manufacturers produced machines according to their own technical specifications. Typically, 1/2” tapes could be reliably played on other machines of the same model they had been recorded on, but there was a lack of interoperability between brands. This created massive problems for those who wanted to share with others the new video content they were creating. In late 1969, The Electronic Industries Association of Japan (EIAJ) established a technical standard for recording video information on 1/2” magnetic tape. This standard stipulated the tape width, tape speed, track angle, diameter of the head drum assembly, as well as a layout for the audio, video, and control tracks. Although the revolutionary aspects of video technology had already begun to percolate into the world of artists and media-makers, the EIAJ standard (and the new equipment employing it) greatly enhanced the ease with which users could successfully connect with and share video.

One of the first consumer video tape recorders (VTRs) utilizing 1/2” open reel tape was the Sony CV-2000, reaching the US in 1965. The unit was advertised as suitable for both in-home recording of television programs or outdoor situations using a separately sold video camera¹. The extent of the

¹ Video History Project, “Sony CV-2000,” Experimental Television Center, <http://www.experimentaltvcenter.org/history/tools/ttool.php3?id=51&page=1>.

innovations video could offer was made much clearer with the 1967 release of Sony's DVK-2400 "Video Rover" Porta Pak, which condensed the VTR into a shoulder pack and packaged it with a handheld TV camera. 1/2" tapes made on the Porta Pak could then be played back on any Sony CV series VTR². The Porta Pak is a legendary piece of consumer technology, obviously renown for its portability which greatly expanded mobility when recording in the field. More than that though, the Porta Pak drove home the unique aspects of video recording which set it apart from film: a) images recorded on videotape were capable of being played back immediately without being processed in a lab b) video recorded synchronous sound with an ease that was then unrivaled by any film technologies c) rather than being seen as mimicking film, the aesthetics and immediacy of video had more in common with television. These new technological capabilities invited users to experiment with video, for its streamlined approach to documenting events, for the immediate visual feedback that a video system could offer, and for the empowering aspects of video as a means of producing and distributing content.

While the new modes of representation opened up by video invited diverse new applications, the potential of the medium was not fully realizable before the establishment of the EIAJ standard. Those experimenting with the use of video in journalism, the arts, and industrial applications were hampered by the inability to distribute and circulate video content, as the lack of compatibility between VTRs made sharing tapes problematic. Strides towards standardization

² "Video Preservation Resources—Hardware," Bay Area Video Coalition, <http://www.bavc.org/preservation/dvd/resources/hardware.htm#3650>.

came a lot quicker for a format like 2" quadruplex video, which was the professional standard for television studios. Because it was the format for recording broadcast television for retransmission, there was an obvious commercial interest in the standardization of 2" recording. However, recording using 1/2" helical scan equipment was mostly limited to non-professional or institutional use, user groups which did not have the same clout to push for interoperability standards. Looking at an October 1968 report from the Society of Motion Picture and Television Engineers (SMPTE) on the use of helical-scan recording in non-broadcast television, we can get an idea of the problems this lack of standards generated for early American users of video equipment:

“Dr. Jacob Weins, of San Mateo College, concluded after a study that ‘It is obvious that there is absolutely no compatibility between different manufacturers.’...’This incompatibility between different models of recorders is most important to those interested in distribution or exchange of video tapes...Before purchasing a helical-scan recorder, the true value of the ability to exchange tapes with others should be seriously considered....What is needed, however, is the development of industry-wide standards such as exist for quadruplex recorders and motion-picture film. The helical-scan recorder is no longer a toy or gimmick but a useful tool which would be more useful if it were standardized.”³

Although SMPTE worked as an organization to endorse the creation of 2" quadruplex standards, they did not engage in advocacy for 1/2" standards. Beyond the professional/non-professional divide between the formats, this is seemingly owing to the fact that American firms (Ampex, RCA) were the key producers of 2" equipment, whereas 1/2" technology was basically dominated by Japanese corporations (Sony, Panasonic), with whom SMPTE had little pull. It is generally assumed that the 1/2" standardization eventually undertaken by

³ “An Evaluation of Nonbroadcast TV Facilities,” *Journal of the SMPTE*, October, 1968, 1041.

Japanese electronics corporations was done for commercial purposes rather than out of altruistic concern for users.⁴ Nonetheless, the hopes of 1/2" video users would finally be met in August 1969 when the EIAJ issued their Type 1 Standard: 1/2" wide tape, running at 7.5 in/s, a 4.55 in diameter head cylinder, with a 1mm wide audio track along the top edge of the tape and a .8mm control track along the bottom.⁵ EIAJ utilized the already existing format of 1/2" polyester tape (normally on 5" reels), backed with carbon to reduce static electricity and coated with magnetized iron oxide particles suspended in a binder base. The breakthrough brought about by EIAJ was simply that it standardized the technical specifics of *how* information was written onto 1/2" tape, allowing it to be readable by any EIAJ-compatible machine.

This newly established standard was rolled out in the Sony AV-3400 Porta Pak, released in Japan in 1969. Retailing for \$1,495 in 1970, this black and white deck showed many improvements (besides employing the new standard), allowing immediate playback of video through the camera's eyepiece.⁶ One unfortunate consequence of the new EIAJ AV series machines was that they were unable to play tapes made on the CV series decks, which had utilized a system called "skip-field" recording. Whereas the new EIAJ machines employed two video heads in the drum cylinder, CV machines only had one read/write head, with a dummy head "skipping" past the tape (and duplicating the signal

⁴ Robinson, Richard. *The Video Primer* (2nd Ed.). New York: Quick Fox, 1978, 259.

⁵ "EIAJ Standards for 1/2-in Videotape Recorders," Submitted by Yoshio Sawaji, *Journal of the SMPTE*. v.79, December 1970, 1091.

⁶ Video History Project, "Sony AV-3400 Owner's Manual," Experimental Television Center, <http://www.experimental-tvcenter.org/history/tools/ttool.php3?id=46&page=1>.

read/written by the other head) during one half of the head drum's rotation.⁷ In 1970, another important Sony machine that popularized EIAJ arrived in the AV-3650, a higher end studio model of the AV-3400 which included electronic editing features enabled by a capstan servo mechanism, 60 minutes of recording time (as opposed to 30 with the AV-3400), as well as the ability to dub an audio track over existing video.⁸ Color machines would eventually arrive, with Sony and Panasonic introducing color VTRs in 1972 and 1973 respectively. Released in 1974 as a color equivalent of the AV-3650, Sony's much-loved AV-8650 merits a special mention as well.⁹ These color decks were compatible with the EIAJ standard—they could play black and white EIAJ tapes and color tapes could be played back in monochrome on older machines.¹⁰ Although Sony popularized the EIAJ standard, other manufacturers (including Panasonic, who made some well-regarded models, including a portable) began producing equipment employing it throughout the early 1970s.¹¹

With the confidence that EIAJ would allow video content to be shared and distributed, more users turned to video to meet their needs. We should here reexamine some of what made video unique at the time, and how these features caused users to gravitate towards it. As noted, in the early 1970s video was the

⁷ Lab Guy's World, "Sony CV Skip Field Recording," http://www.labguysworld.com/Format_CV2K.htm.

⁸ Video History Project, "Sony AV-3650 Videocorder Operator's Manual," Experimental Television Center, <http://www.experimentalvcenter.org/history/tools/ttool.php3?id=47&page=1>

⁹ Bensinger, Charles, *The Video Guide* (2nd Ed.), Santa Barbara: Video-Info Publications, 1981, 16.

¹⁰ Bensinger, 15.

¹¹ Harris, Aubrey, "Selecting a Video Tape Recorder," *Electronics World*, February, 1971, 15.

most convenient way to record a moving image with synched sound (it's closest competitor was 16mm film with a magnetic soundtrack). Most importantly, it allowed for immediate playback of content after recording. A useful article in the early video publication *Radical Software* discusses both the logistical and theoretical considerations of using video, as opposed to 16mm or Super 8 film. These two film formats were the only other options for documenting moving images that approached the mobility and cost-effectiveness of 1/2" video. The author breaks down the basic financial outlay for the equipment and media (see chart p.7), as well as the advantages and limitations of each format. The article presents video as the speediest and most affordable way to go, although it notes that techniques for editing on 1/2" video equipment were nowhere near as precise as of those available with film. Small gauge film perhaps gave video a run for its money with regard to portability and initial overhead cost, but it was what was technologically unique about video (immediate images, stock with a longer running time and which could be reused) that drew users to it. Aside from these film alternatives, 1/2" open reel faced few competing formats (before the introduction of cassette technology). In some ways Akai's portable VTR, utilizing 1/4" tape and first introduced in 1969, was competing for similar turf, although it was not compatible with any other system and featured poorer image quality than 1/2".¹² While other formats of VTRs existed, no portable models of 1" or 2" machines were available, and studio decks for these formats were dramatically more expensive than 1/2" equipment. However, due to many irregularities and

¹² Bensinger, 18.

eccentricities of editing with an AV-3650, 1" machines (such as the Sony EV series) were frequently used to edit master tapes of footage recorded on 1/2" equipment.¹³

	½ IN. TAPE	16MM	SUPER 8
CONTINUOUS RECORDING TIME:	30 min.	11 min. (400 ft. magazine)	2 min. 40 sec.
SHARPNESS:	slightly below Super 8	double that of Super 8	slightly better than ½ in. tape
PRICE OF MATERIALS:	\$12/½ hour	\$40/11 min. (B&W mag stripe processed) \$110/½ hour	\$4.00/2 min.—40 sec. (processed) \$45/½ hour
PRICE OF EQUIPMENT:	camera & port. deck \$1500 editor 1000 monitor 250 \$2750	camera \$1400 projector 700 editor 150 tape recorder 400 \$2650	camera \$250 tape rec. 100 editor 30 projector 250 \$630
WEIGHT:	camera 4 lb. port. deck 16 lb. 20 lb.	camera 9 lb. tape recorder 6 lb. 15 lb.	camera 3 lb. tape recorder 4 lb. 7 lb.

from *Radical Software* v.1 no. 3, Spring 1971

Radical Software was not just a source for practical information about hardware developments and self-repair, but one of the most interesting sites of conceptual theorizing about the dreams video technology could realize. The

¹³ O'Donnell, Leo and Leonard A. Green, "Modifications to Videotape Recording Equipment to Provide an Improved Method of Editing 1/2-Inch Recordings," *Journal of the SMPTE*. v.82, July 1973, 554.

journal (originally more of a zine) drew from a community of New York artists and media makers who were fascinated by video's ability to instantly re-present a mediated image, as well as by the fact that video equipment greatly reduced the cost and cumbersomeness of creating media content. Indeed, you have to exercise your historical imagination to comprehend today how revolutionary the idea of being able to "make your own TV" was in the early 1970s. Critics of the cultural hegemony of television and mass media saw these lower cost, infinitely more portable video tools as a powerful step towards diversifying and personalizing representations of social reality, harboring great hope for video's potential to alter our media landscape:

"Portable video is a new, major medium. It is a high access form of our culture's dominant communications mode and precisely the opposite of product television, which can accept only artificial behavior because it is based on scarcity of time and equipment access. The economics of portable video are subversive to anyone whose authority and security are based on controlling information flow...Unlike product television, the Porta-Pak embodies technological evolution towards decentralization ...The bias of self-contained record, storage, and instant playback punctures the estranging mythology of technology as something to be operated and therefore controlled by an elite."¹⁴

Besides the issues of portability and democratization of media content, it was the idea of "immediate feedback" which stimulated interest in video across a diverse range of prospective users. At the time, the only other existing technology for capturing moving images was film, with chemical processing at a lab required in order to produce a visible image. The immediacy of video encouraged applications where feedback or visual instruction was required, but where the processing and one-time use of film stock was not feasible. In this same

¹⁴ "Meta-Manual," *Radical Software*. v.1 no. 3, Spring 1971, accessed at <http://radicalsoftware.org/e/volume1nr3.html>.

comparison between video, 16mm, and Super 8, the author in *Radical Software* underlines how this distinction affects the uses to which the media are put:

“the film process is a one way avenue out from experience recorded, as tape is both an avenue out, and a circuit of immediate feedback into the experience as it occurs...It is this capability which gives tape a clear advantage over film for use in all forms of educational experience, from encounter groups to industrial training, where it is valuable for people to see themselves in action as others see them”¹⁵

This ability to immediately review (and then overwrite, if desired) audiovisual content secured many industrial and commercial uses for video. Even prior to EIAJ standardization, video began to be employed in business contexts providing visual aides for sales presentations, training new employees, and also as a medium to which security cameras could record surveillance footage.¹⁶

Some of the most technically informed 1/2” open reel enthusiasts from the early video era were artists, and the video art they created has become some of the most lastingly influential content captured through the medium. A diverse group of artists were drawn to the use of video, both for the low-overhead documentation of visual events as well as much more experimental applications which allowed for the manipulation of the electronic signals comprising the video image itself. Much of the work of users who pursued the idea of locally-produced “alternative television” is termed video art today, like the tapes made by the Videofreex collective during their establishment of an interactive community television channel in bucolic Gainesville, NY. Artists like Bruce Nauman and Vito

¹⁵ Jaffe, Louis, “Videotape Versus Film: Half Inch, 16mm, and Super 8,” *Radical Software*, v.1 no. 3, Spring 1971, accessed at <http://radicalsoftware.org/e/volume1nr3.html>.

¹⁶ Efrein, Joel Lawrence, *Video Tape Production & Communication Techniques*, Blue Ridge Summit, PA: Tab Books, 1975, pp. 25-52.

Acconci used 1/2" video both to rehearse, and then document some of their performance-based art pieces. Others, like Nam June Paik, devoted themselves to sophisticated reordering of the video image itself, creating synthesizers which allowed them to distort and color the electronic embodiment of visual information contained in the video signal. These three prevailing tendencies were highlighted in a 1974 conference on video art held at MoMA, with an essay about the summit terming them the political, conceptual, and imagist approaches.¹⁷ An adequate survey of video art is beyond our scope here, but a look at 1/2" open reel video would be remiss to leave out the aesthetic turf it staked out through the technological capabilities offered by the medium.

What was initially radical about 1/2" open reel as a format derived from advances in portability and the uniqueness of video itself. Despite being excitedly adopted by many users, a certain measure of technical prowess was required to operate 1/2" decks, even if one was simply attempting to play back a tape. While the skill required was not prohibitive for many institutions or tech-savvy users, the technology amounted to enough of a hurdle to keep 1/2" open reel from being a suitable medium for the general public. One limiting factor was the need to thread the tape through the deck and onto the take-up reel. This not only required handling of the tape itself, which could damage the tape or ultimately introduce dirt and oil onto the heads, but could also lead to further problems arising from improper threading. Beginning in the early 1970s, solutions to threading problems and the general fragility of tape were put forth in the form of various

¹⁷ Simmons, Allison, "Television and Art: A Historical Primer for an Improbable Alliance," *The New Television*, Cambridge, MA: MIT Press, 1977. 15.

cassette technologies. In light of technical niggles presented by the open reel, the advantages of cassette systems were seen as such:

“Since the tape remains in a sealed container and is threaded automatically in a videocassette system, the trouble-free life of the tape and video unit is greatly extended. Videocassette machines are particularly ideal for playback and recording situations where a variety of untrained people must operate a video machine.”¹⁸

Surprisingly, early videocassette technology actually attempted to stay true to 1/2” EIAJ standardization. One unsuccessful stab at this idea was the Ampex Instavision system, which still utilized an open reel, but featured drop-in loading and automatic threading of the tape—prototypes were made, but the unit was never produced.¹⁹ Along the same lines were the early EIAJ cassette systems, originally introduced by Panasonic’s Omnivision unit, which simply housed standard 1/2” EIAJ tape inside a cassette.²⁰ However, a whole new format would come along to usurp the place 1/2” open reel EIAJ tape in Sony’s 3/4” U-Matic cassettes. Although first introduced in 1971, it would not be until the mid or latter part of the decade that U-Matic technology would be affordable enough to thoroughly displace the use of 1/2” tape. Offering color and image quality superior to 1/2”, as well as the convenience of a cassette, U-Matic was able to further the advances in mobility made by the Porta Pak, and went on to become widely utilized for many of the institutional and news-gathering applications which 1/2” had once served.

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¹⁸ Bensinger, 131.

¹⁹ Siegel, Eric, “Equipment Standards,” *Radical Software*. v.1 no. 3, Spring 1971. accessed at <http://radicalsoftware.org/e/volume1nr3.html>.

²⁰ “Video Format Guide,” Vidipax, accessed at <http://www.vidipax.com/formatgd/fg17.html>.

- “An Evaluation of Nonbroadcast TV Facilities.” *Journal of the SMPTE*. October, 1968.
Discusses the cost and portability benefits of 1/2” helical scan equipment, but as 1/2” standards had not yet been established, warns about the lack of compatibility between machines.
- “EIAJ Standards for 1/2-in Videotape Recorders.” Submitted by Yoshio Sawaji. *Journal of the SMPTE*. v.79, December 1970.
Although SMPTE did not collaborate on the establishment of the EIAJ 1/2” standards, they did publish an English language translation of its specifications.
- “Video Format Guide.” Vidipax. <http://www.vidipax.com/formatgd/fg17.html>.
A fairly exhaustive timeline of video formats.
- “Sony CV-2000,” Experimental Television Center, <http://www.experimentalstvcenter.org/history/tools/ttool.php3?id=51&page=1>.
Background information, as well as the original product literature for the Sony CV-2000.
- “Sony DVK-2400/VCK 2400 Battery Operated Videocorder/Camera Ensemble,” “Sony AV-3400 Videocorder Owner’s Instruction Manual,” “Sony AV-3650 Videocorder Operator’s Manual” accessed at http://www.labguysworld.com/VTR-Museum_003.htm.
Scans of the original instructional materials that accompanied these important pieces of equipment.
- Bay Area Video Coalition. ““Video Preservation Resources—Hardware.” <http://www.bavc.org/preservation/dvd/resources/hardware.htm>.
Useful timeline of 1/2” open reel hardware.
- Bensinger, Charles. *The Video Guide* (2nd Ed.). Santa Barbara: Video-Info Publications, 1981.
A very thorough overview of video recording technology and techniques. Extensively details varying formats with background information on many different models of VTRs and VCRs.
- Davis, Douglas and Allison Simmons ed.. *The New Television*. Cambridge, MA: MIT Press, 1977.
A book based on a 1974 conference at the Museum of Modern Art entitled “Open Circuits: An International Conference on the Future of Television.” Offers more of an art historical approach to video art and the culture of television, including many theoretical texts by artists.
- Efrein, Joel Lawrence. *Video Tape Production & Communication Techniques*. Blue Ridge Summit, PA: Tab Books, 1975.

In addition to a wealth of photos and diagrams, this book contains many case studies, relating video projects (in education, employee training, sales, etc) various companies and organizations have embarked on.

- Harris, Aubrey. "Selecting a Video Tape Recorder." *Electronics World*. February, 1971.

Evaluates the different VTRs on the market, enthusing about the new EIAJ standard as being a "big step forward" in that there are less worries about interoperability of tapes when selecting what type of machine to purchase. Includes a chart with basic technical specs of all the major models and brands of VTRs, including list prices.

- Jaffe, Louis. "Videotape Versus Film: Half Inch, 16mm, and Super 8." *Radical Software*. v.1 no. 3, Spring 1971. accessed at <http://radicalsoftware.org/e/volume1nr3.html>

Compares and contrasts not just the differing aesthetics of video versus film, but also the financial breakdown including price of 'stock' and overhead equipment costs.

- Kybett, Harry. *How to Use Video Tape Recorders* (1st Ed.). Indianapolis: H.W. Sams, 1974.

Contains lots of information about technical specs and repair, but also features a very thorough chapter on "Uses of the VTR" which describes diverse applications of video in education and business settings.

- Kybett, Harry. *The Complete Handbook of Videocassette Recorders* (1st Ed.). Blue Ridge Summit, PA: Tab Books, 1977.

A look at videocassette recording as opposed to the VTR. Contains a useful perspective about what new users cassettes can reach, those who could benefit from using video but did not have the technical know-how to use open reel equipment.

- LabGuy's World. "Museum of Extinct Video Recorders and Accessories." http://www.labguysworld.com/VTR-Museum_001.htm.

Handy website with photos and capsule summaries of many obscure VTR models.

- Mattingly, E. Grayson. *Introducing the Single-Camera VTR System*. New York: Scribner, 1973.

A wide-ranging volume that covers the basics of setting up your own small video system, with lots of editorializing about the importance of democratizing access to the creation of media content.

- O'Donnell, Leo and Leonard A. Green. "Modifications to Videotape Recording Equipment to Provide an Improved Method of Editing 1/2-Inch Recordings." *Journal of the SMPTE*. v.82, July 1973.

This article quickly addresses the limitations of the editing capabilities of the Sony AV-3650 (a popular 1/2" EIAJ studio deck).

- Remley, Frederick M. "Activities of the Helical Recording Subcommittee of the Video Tape Recording Committee." *Journal of the SMPTE*. v.79, December

1970.

Summarizes the feelings of some US helical scan users, documenting their complaints about the need for format standardization. Acknowledges 1/2" EIAJ standard, but stresses the need for 1" standards as well, due to the technical limitations of 1/2".

- Robinson, Richard. *The Video Primer* (2nd Ed.). New York: Quick Fox, 1978. A really expansive book covering the world of video at the time, while also detailing hardware setups and offering production tips. Concisely surveys why 1/2" standardization came about.
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- Videofreex. *The Spaghetti City Video Manual*. New York: Praeger, 1973. A whimsical maintenance and repair manual for 1/2" open reel video users. Useful for insight into the technical limitations of 1/2" hardware at the time, particularly with regard to editing or attempting to broadcast 1/2" tapes on television.