Kristin MacDonough
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Philips Videocassette Recorders

Although it was not the first videotape recorder (VTR) in a cassette format, it is widely agreed the Philips N1500 was the first *domestic*videocassette recorder (VCR) intended solely for home use. The videotape recordersprior to it were open reel and cartridge formats used only in the industrial and educational fields. Philips developed a number of VCR models, from the pioneering N1500, first releasedin 1972 and only in Europe, to the highly advanced Video2000 (V2000) series, the company's final attempt to enter the home video cassette recording market.

The N1500 was the first video tape recorderof its kind and the V2000 was an innovative and cutting edge machine. Both products should have made Philips an internationally dominating brand in the video recording industry, so why were the Philips VCRs overall a commercial failure? In order to understand the Philips VCR systems, we must first understand the company and its role in the consumer electronics industry. This paper will explore the historical relevance of Royal Philips Electronics (Philips), other technologies leading to the development of the VCR, and the design of the N1500 and V2000 VCR systems in order to understand why they failed. By reviewing earlier technologies, this paper will alsodemonstrate how products build upon their predecessors.

Philips originally coined the term "videocassette recorder" even though the terminology is used freely to describe most cassette recording systems. For the purpose of this paper, and in an effort to avoid confusion, VCR will only refer to Philips models, and all other systems will be identified either by their specific identities (i.e. U-matic, VHS, etc.) or by format (open reel or reel-to-reel,cartridge, andcassette). All systems fall under the umbrella of VTR.

Royal Philips Electronics

Philips was founded in 1891 in Eindohoven, the Netherlands and started out producing carbon-filament lamps. Spurred by the Industrial Revolution in Europe, the company established its research and development department in 1914, with a concentration on radio and lighting technologies. Since then, the company has conceived and developed a wide array of products for the industrial and consumer markets.[1]

When Philips wanted to establish a corporate presence in the United States, the existence of Philco (Philadelphia Storage Battery Company) prevented Philips from advertising itself due to the fact both companies operated in the electronics business. Beginning in the 1940's, the company advertised and distributed all

[1] "History," *Philips Electronics N. V.*, Last accessed November 27, 2011. http://www.usa.philips.com/about/company/history/index.page.

electronics in the U.S., mostly razors, under the Norelco (North American Philips Electrical Company) brand name.[2]

Philips first introduced the compact cassette to the European market in 1962. The product was next introduced in the U.S. in 1964 under the Norelco label and the company was able to trademark the name *Compact Cassette.*[3] Philips had been working with magnetic tape for about two decades already and was considering partnering with CBS (Columbia Broadcasting System) electronics to develop a recording cartridge. However, CBS wanted to develop a large cartridge system and the engineers at Philips disagreed with this concept. Instead, the Philips engineers based their design choices on the advantages offered by previous products,most significantly,a small size with a simple construction that allowed for greatest tape protection.[4]

The licensing strategy utilized by Philips was the key to the success of the compact audiocassette. While the idea of attempting to control the market and charging a fee for the designwas considered, Philips decided to license the product for free. The company claimed "Philips should allow other manufacturers access to the design, turning the compact cassette into a world product."[5] The concept was a triumph, not only for the company but for the product as well. By providing free licensing, other companies were equipped to improve and expand upon the design

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[2] "Philishave and Norelco History," *Philishave Collectors Club.* Last modified November 27, 2011. http://home.wanadoo.nl/philiclub/indexeng.htm.
[3] David Morton, *Sound Recording: The Life Story of a Technology* (Westport: Greenwood Press, 2004), 165-167.
[4] Eric Daniel, *Magnetic Recording: The First 100 Years* (Piscataway: IEEE Press, 1999), 102.
[5] Ibid., 103-104.

rather than develop their own competitive, and likely incompatible, products. Philips engineers benefitted from theseinnovations as well, and the companyremained one of the leading audiocassette manufacturers in Europe. Enhancements on the economical design and the greater sound quality of the compact cassette are presumably what led to the demise of the 8-track tape in the audio format battle.

In the 1970's, Philips began acquiring several companies, most notably Magnavox and Philco.[6] When Philips bought Magnavox in 1974, they began licensing electronic products in the U.S. under the Philips Magnavox name while keeping healthcare products under the Norelco title.[7] Norelco razors are still a popular consumer product.The acquisition of Philco 1981 allowed Philips to begin advertising under its own name in the U.S. although most products are still licensed as Philips Norelco. Public familiarity with the brand name is significant to the company's continued success.[8]

Following the triumph of the compact audiocassette as a worldwide standard, Philips began to focus its attention on the growing market of video recording.

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[6] Ron Ramirez, "The History of Philco. Chapter 8: The Later Years (1946-1961)," *Philcoradio.com,* 2011. Last accessed November 27, 2011. http://www.philcoradio.com/history/hist8.htm.

[7] "The Quest for Home Video: Chronology." *Terra Media.* Last accessed November 26, 2011. http://www.terramedia.co.uk/media/video/video_chronology.htm.

[8] "Final Transcript: PHG - Q2 2007 Royal Philips Electronics Earnings Conference Call." Thomson Financial. July 16, 2007. Accessed November 26, 2011. http://www.philips.com/shared/assets/Downloadablefile/PHG-Transcript-2007-07-16T08-00.pdf.

Early Videotape Recording

Video recording is anchored in the fundamentals of audio recording on magnetic wire or tape, and a very simplified timeline is presented here. Valdemar Poulsen developed the Telegraphone in 1898. He discovered that if a steel wire or ribbon was passed through an electromagnet, itwould becomepermanently magnetized by the "variable electric currents generated by the vibrations produced [from] acoustic impulses."[9]The Telegraphone would then read the magnetized strip and replay the information, meaning the recorded electric currents, attached to it. This discovery led to steady progress in magnetic wire recording until Fritz Pfleumer conceived and designed a magnetic substance with the same attributes that could be applied to a non-magnetic backing.[10]

In order to reproduce a sound or image, the sound vibrations and visual signals are transformed into electrical signals through a target, usually a microphone or video camera. For video, the target is light sensitive. In a process called scanning the light image is transformed by an electron beam into electric signals. The electric signals are sent to phosphors (metallic chemicals), which reproduce the light through another electron beamand scan the information onto the television screen.[11] These electric signals become more important in

[9] Aaron Foisi Nmungwun, *Video Recording Technology: Its Impact on Media and Home Entertainment* (Hillsdale: Lawrence Erlbaum Assocs., Inc., 1989) 39.
[10] Ibid., 59.
[11] Marcus Weiss and Diana Weynand. *How Video Works, 2nd ed.* (Burlington: Focal Press, 2007) 15.

establishing system standards andalso formodern recording practices on magnetic tape.

The NTSC (National Television Standards Committee) system is the first standard for both black and white (est. 1941), and color (est. 1953). In this standard, a video frame consists of 525 lines per frame created and redistributed by the electron beams at thirty frames per second. NTSC is implemented in North and Latin America, and in parts of Asia, most notably Japan. In comparison, there is the European standard, PAL (Phase Alternate Line), which applies 625 lines per frame at twenty-five frames per second.[12] PAL is essentially a better version of the NTSC model because more information is processed per frame. It is also utilized more globally. The third color standard is SECAM (Séquential Couleur à Mémiore), which was developed in France. It is employed both there, in the former USSR and parts of Africa. SECAM also uses the 625 lines standard, making PAL and SECAM compatible.[13]These standards affect how the signal is recorded onto the tape. Since the NTSC standard is incompatible with PAL an SECAM, anything recorded on NTSC is incapable of playing on PAL or SECAM.

Modern magnetic tape is made up of a topcoat, a substrate and a back coat. The topcoat is composed of the magnetic particles such as iron oxide or chromium dioxide, head cleaning lubricant, and other chemicals, all of which areheld together by a binder. The substrate, or base, can be acetate, paper, or a polyester

[12] David K. Matthewson, *Beginner's Guide to Video.* (London: Butterworth & Co. (Publishers) Ltd., 1982) 15.
[13] Ibid., 18.

derivative. After the 1950s, nearly all bases are a polyester derivative especially in videotape. The backcoat is optional but is now standard due to preservation benefits of including it.[14]

Recording and playback on the tape requires a "head" component in the tape machine. The head creates a magnetic field based on the aforementioned electric signals being sent to it. The field in turn aligns the magnetic particles on the tape, which correspond to and represent the signal. The first heads were shaped like a stylus from a phonograph but the point cut into the tape. Next, linear tape recording was designed and composed of a ring shaped tape head, which pressed evenly against the tape and would not result in tearing.[15]

The above is important because it lead to the development of helical scanrecording in the fifties, an improved version of linear scan recording. The video head was housed in a cylinder with the tape forming a U shape around the cylinder. This system had several benefits such as allowing for still frame or slow motion, and being more cost efficient.[16]

Early videotape recording began in an open reel format and required more handling of the tape. Naturally, it was easy to damage the tape. The advent of cartridges and cassettes, a more durable alternative, would win out. The cassette, the smaller format of the two, would then beat out the cartridge as the design of

[14] Jim Wheeler, "Video Preservation Handbook." *amianet.org*, last accessed November 25, 2011.
[15] Nmungwun, *Video Recording Technology,* 62.
[16] Ibid*.,* 146.

choice. Two of the most notable predecessors to the Philips VCR were the 2" Quadraplex (open reel) and the ¾" U-matic (cassette) formats.

The Quadraplex, or Quad, was the first functioning VTR developed by Ampex in 1956 and it quickly became the broadcasting standard. The Quad used four rotating video heads (hence 'quad'), while its predecessors used stationary heads. The system also utilized 2" magnetic tape for recording, which gaveit a bulky format.[17] The products reliability kept it in use until the mid 1980's as both a recording and broadcasting standard.[18]

However, the 2" Quad and other open reel systems were generally incompatible and standardization was not established until the EIAJ (Electronic Industries Association of Japan) standards were developed in the late 1970. EIAJ-1 (black and white) and EIAJ-2 (color) were established for standardization in reel-to-reel formats.[19] It established ½" tape as the norm and also "stipulated the … tape speed, track angle, diameter of the head drum assembly, as well as a layout for the audio, video, and control tracks."[20] Even with these standards, most equipment and formats remained incompatible.

In 1969, Sony announced the forthcoming Color Videoplayer. The product was meant to the first step for breaking into the home entertainment market.

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[17] Matthewson, *Beginner's Guide,* 66.
[18] "Identity Format: 2" Quad," *Texas Commission on the Arts: Videotape Identification and Assessment Guide.* Last accessed November 27, 2011. http://www.arts.state.tx.us/video/id/quad.asp.
[19] "EIAJ Standards for 1/2-in Videotape Recorders." Submitted by Yoshio Sawaji. *Journal of the SMPTE*. v.79 no. 12, (December 1970) 1091.
[20] Villereal, Steven. "Format History — 1/2" EIAJ open reel video." (Student research paper, New York University, 2007) 1.

What was released was the U-matic cassette in 1971, and its sturdinessallowed it to become an industrial and educational recording standard in Japan, the U.S. and Europe.[21] The ¾" reel videocassette was easily preferable to open reel, such as the 2" Quad, as it provided a better way to transport and edit videotape. Besides Sony, it was available through various Japanese companies including JVC (Victor Company of Japan), and Matsushita, making the U-matic the "first successful inter-manufacturer standard for encapsulated helical videotape system."[22] The U-matic was never designed for domestic use and did not entirely conform to the EIAJ standards since it was being developed before the standards were implemented. Still, it set the foundation for the Betamax and VHS (Video Home System) formats which would later dominate the market.

During this time, several companies continued to produce open reel home video recorders, but these would quickly be dismissed in favor of cassettes.

Philips VCR: N1500

Philips announced their intentions to provide a cassette format for video recordingin the home marketbefore any other company. Most businesses, such as Sony and Ampex, were promising more VTR cassettes for the industrial and

[21] "Chronology," *Terramedia.com.*
[22] Aaron Foisi Nmungwun, *Video Recording Technology: Its Impact on Media and Home Entertainment* (Hillsdale: Lawrence Erlbaum Assocs., Inc., 1989) 148.

educational markets with intentions to make the products available for home use in the future.[23]

The N1500 premiered with moderate fanfare. A small paragraph in the March 1972 Journal of the SMPTE (Society of Motion Picture and Television Engineers)publicizes it: "The machine will incorporate an on-off time clock to make tapes of TV broadcast programs when no one is at home. This machine is the only one so far which can claim to be any kind of a standard device, since several other European firms have promised to make machines which will play the same cassettes."[24] The article is drafted from an announcement made in October of the year prior.

This makes the N1500 the first to fulfill the promise of moving towards standardization in videocassettes. From an ad printed in National Geographic in 1972, "Looking to the future, Europe's leading manufactures of TV and recording equipment decided to standardise [sic] on the VCR Cassette. It's as compact as a paperback, yet it holds a 60 minute recording. All over Europe, VCR Cassettes can be recorded and exchanged because they and the Video Cassette Recorders are based on the VCR system, developed by Philips."[25]This is great news for standardization but the inherent flaws of the system were troublesome for the wider international market.

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[23] "Chronology," *Terramedia.com.*
[24] Wilton R. Holm, "Socio-Economic Aspects of Video-Player Systems — A Perspective." *Journal of the SMPTE* v. 81, no 4 (May, 1972): 154- 156.
[25] "Europe United," Advertisement by Philips, (National Geographic, 1972).

The Philips recorder utilized the ½" iron-oxide tape, helical scan recording, and coaxially mounted reels (one on top of another).In previous cartridge and cassette designs, like the U-matic, the reels are mounted side by side. The concentric format of the N1500 would prove mechanically problematic because the tape could easily tangle and stretch in the machine.[26] The V2000 would later correct this issue.

At a technical committee in May of 1972, a review of the Philips VCR proposal demonstrates that the company was not fulfilling its original objectives, and quickly becoming more complex than first intended. This was viewed as creating a delay not only establishing standardization for the PAL market, but also in standardizing videocassettes and recorders internationally. The design flaws of the machine were not fully realized until after it was released, and many companies were not willing to standardize a format with so many inherent problems. From the same review: "The Netherlands [Philips] affirmed, with regard to its video cassette proposal, that the same policy would apply as for audio cassettes with no special patents restricting the use of the format."[27]Albeit the drawbacks, Philips was still intending to set the worldwide standard as they had with the compact cassette.

[26] Matthewson, *Beginner's Guide,* 68.
[27] Joseph Roizen, "International Electrotechnical Commission Meetings of Technical Committee 60 (Recording), SC 60B." *Journal of the SMPTE* 81, no. 8. (August, 1972): 615.

While developing the V2000 series, Philips released the N1700. This series was nearly identical in design to the N1500's and intended as a placeholder so Philips could maintain a presence in theVTR market.

In other parts of the research and development lab, Philips was also exploring the possibilities of Videodisc recording. In 1974, Philips joined forces with MCA, the owner of Universal Studios, to produce and distribute laser disc technology for playback.[28] However, by the time the drawbacks of the N1500 and Videodisc systems of the era were worked out, most countries, in Europe and beyond, were beginning to embrace video tape recording in Betamax and VHS.

The Competition: Betamax and VHS

Sony introduced Betamax in 1975 as an alternative to Philips VCR. As mentioned earlier, Sony first produced the U-matic system, an industrial and educational standard. They then developed the Betamax based on the U-matic and Philips designs. With the Betamax, Sony had once again designed a system of interoperabilitybut utilizing the ½" standard this time.[29] Other manufacturers to produce the Betamax format included Hitachi, Toshiba, and Sanyo.

However they were not to be outdone. JVC chose not to go with the Betamax format andthey released VHS one year later with support from both Japanese and U.S. markets, including RCA and Matsushita. This was a surprising

[28] Frederick Wasser, *Veni, Vidi, Video: The Hollywood Empire and the VCR* (Austin: University of Texas Press, 2001), 63-64.
[29] Nmungwun, *Video Recording Technology*, 153-154.

twist for Sony sinceboth JVC and Matsushita had formerly produced the U-matic format.[30]The VHS system was based on its predecessors, including Betamax this time, yet the two were incompatible.

Philips V2000

The truly revolutionary product for Philips was the V2000 series, also called the Video Compact Cassette (VCC). In February of 1980, Philips and Grundig, a German manufacturer, teamed up to develop and release this system. They tried to create standardization through collaboration, although Philips held most of the market.[31] The system continued to use the ½" wide tape and helical scan recording criterion set by EIAJ. Between 1980 and 1985, The V2000 came in several different versions, each improving on the last, and all renditions offered several advantages over Betamax and VHS.

Similar to the audio compact cassette, it could record on one side and be flipped over to record on the other. Therefore, it technically recorded on ¼" tape. With four hours of recording time on each side this provided a total of eight hours of recording time on one cassette.The machinespossessed an optical system, which detected the reflective strips at either end of the tape alerting the recorder to stop the tape.[32]The V2000 also introduced Dynamic Track Following (DTF). Video

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[30] Albert Abramson. *The History of Television, 1942-2000.* (Jefferson: McFarland & Company Inc., Publishers, 2003) 173-174.
[31] Ibid., 186.
[32] "The V2000 Format," *V2000 PALsite,* last accessed November 26, 2011. http://v2000.palsite.com/format.html.

heads were mounted on piezoelectric (electricity from pressure) crystals. This means the movement of the tape across the heads would create pressure on the crystals, which could then generate electric energy allowing the video head to automatically adjust to tracking needs. This discarded the need for a control or tracking button on the system.[33] DTF allowed for superior quality of animage when the tape was paused or played in slow motion.

The V2000 joined the VTR cassette race too late. The DTF was a superior system enhancement, which took many years to cultivate for the home entertainment industry. Betamax and VHS were already well established on the international markets thusmaking the V2000 barely a competitor. Any companies with the ability to produce cassette systems were already developing either VHS or Betamax. An additional limitation already inherent in the Philips VCRs was its development using the PAL system and they never produced an alternate version to fit to the NTSC standards.

In 1985, quite early in the home video format war, Philips quit manufacturing the V2000 series.[34] Soon after, the company began producing VHS compatible VTRs. Although this is not the reason VHS won the format wars, it was certainly a catalyst.

Conclusions

[33] PCB Group Inc. "General Piezoelectric Theory," *PCB Piezotronics,* last modified 2011. http://www.pcb.com/techsupport/tech_gen.php.
[34] "V2000," *TotalRewind.org.* last accessed November 27, 2011. http://www.totalrewind.org/v2000.htm.

When it comes to harnessing new technology, companies learn from their mistakes and most especially from the mistakes of their competitors. Based on my investigation, it would be inaccurate to say the product failed as a device. The N1500 series arrived too soon and the V2000 was introduced too late. Although the V2000 offered several advantages over Betamax and VHS, the system was the third-party candidate in a two party race.The Philips VCRs did not establish the standard because there was simply something cheaper with a wider market. Philips was also impaired by the lack of video standardization in broadcasting. After 1974, the company could license the products in the U.S. under the Philips Magnavox brand name, but they were still hindered by the disparate broadcasting formats. PAL and SECAM were utilized more globally than NTSC, yet NTSC was the system employed in the in the most technologically dominant and progressive companies. Philips attemptedtoestablish the universal videocassette recorder standard the same way it had for the audiocassette but no company could achieve this without amending its design for the global market.

Philips is still a large and influential company. According to their website, they continue to manufacture and distribute electronic innovations. The company's primary markets are home healthcare, lighting and consumer lifestyle products. Their current company profile states "Royal Philips Electronics of the Netherlands is a diversified Health and Well-being company, focused on improving people's lives through timely innovations. As a world leader in healthcare, lifestyle and lighting, Philips integrates technologies and design into

people-centric solutions, based on fundamental customer insights and the brand promise of 'sense and simplicity'."The website provides very little reference to the VCRs produced from 1972-1985. The Philips VCR's also have a small but dedicated following through fan sites and user groups who keep the products in the public memory.[35]Even now, the term VCR is still used to refer to all home video recording machines.

[35] "The Philips VCR group." *Yahoo Groups.* Last accessed November 29, 2011. http://tech.groups.yahoo.com/group/philips_vcr/.