Chapter 1

That Which Has Come Before

Television could perform a great service in mass education, but there's no indication its sponsors have anything like this on their minds.

—Tallulah Bankhead

A man named Bain developed the basic principles of a machine capability of sampling an image and transmitting it electrically to a distant location where it was reconstructed. This precursor to the fax machine was successfully demonstrated in 1862. It dealt only in still images, but inventors were toying with the ways to get the pictures moving.

An 1879 woodcarving depicts two people in a living room watching a wide-screen display that looks remarkably like today's home theatre systems.

Paul Gotttlieb Nipkow made a breakthrough in the development of video technology when he came up with a mechanical process for scanning images. Previous efforts sampled the entire scene simultaneously. Nipkow made use of a spinning metal disk with a spiral pattern of holes to scan a scene a line at a time.

Francis Jenkins used this mechanical technique to transmit a moving image of a Dutch windmill on June 13, 1925. The transmission included synchronized audio[1]. The moving images were backlit silhouettes.

[1] A few years later, in 1929, Jenkins published a book that included a chapter on "How to Make Your Own Radiovisior." It read, "For starters, you will need four No. 10 round-head screws and a block of wood 1.5" × 3.5" × 4", preferably maple…."

John Baird, another inventor, also used Nipkow's concept of a scanning disk to successfully demonstrate a mechanical television system with 30 lines of resolution.

Also in 1926, yet another inventor named Philo Farnsworth transmitted a stationary image of painting on glass. One of his investors asked, "When are we going to see some dollars in this thing, Farnsworth?" The inventor flipped a switch and transmitted an image of a dollar sign. A few days later, he was able to transmit moving pictures of a man smoking a cigarette. The man being recorded had to be so close to the hot lights that he actually blistered his nose.

Scientists at GE, led by Frederik Alexanderson, were also working on television in 1926, transmitting ukelele performances. In September 1928, they broadcast the first television drama, *The Queen's Messenger*. In 1929, the BBC began experimenting with Baird's 30-line broadcast system, televising what they still consider to be the first television drama, *The Man with the Flower in His Mouth*.

The Beginnings of Television

The early 1930's saw a proliferation of different mechanical television systems around the world. Every company had their own technique, and no two were compatible with one another. In general, the quality of the monochromatic broadcasts was poor, being about 30 lines of resolution. Such a resolution is equivalent to smaller icons on today's computers. Achieving higher resolutions using mechanical scanning disks proved impractical, and the mechanical television systems died out by 1935.

They were replaced by electronic systems of much higher resolution on the order of 400-600 lines. By 1936, the BBC was regularly broadcasting 405-line programs. These broadcasts stopped in 1939 very suddenly—in the middle of a program, in fact—due to a little territorial dispute that came to be known as World War II[2].

In the United States, the chaos of incompatible mechanical television systems was replaced by the chaos of incompatible electronic television systems. RCA had a system they used for NBC broadcasts, while Philco Corporation wanted to use a different one, and DuMont still another. The FCC announced in early 1940 that it was taking steps to create a national standard. RCA responded two weeks later by trying to sell as many of its television receivers as

[2] In 1946, the BBC resumed broadcasting exactly where it had left off in the middle of the program it had stopped 7 years earlier. The same announcer came on, and in a fine example of British wit said, "Now, as I was saying when I was so rudely interrupted."

possible at reduced prices, and thus make its format the *de facto* standard, to which the FCC would have to conform.

The Radio Manufacturers Association (RMA) worked with the FCC to sponsor the National Television Standards Committee (NTSC). This committee had representatives from all the major broadcast companies. The goal of the NTSC was to develop a national television broadcast standard so that all television transmitters and receivers would be compatible. With many of the companies already demonstrating color television prototypes, they considered making the standard encompass color, but the final set of standards released on March 20, 1941 only handled monochromatic television with 525 lines.

The FCC formally approved the NTSC standards on May 2, 1941 and announced that commercial broadcasting could begin that July 1st. Indeed, 22 stations across the nation did begin broadcasting using the NTSC standard on July 1st, but just a few days prior, President Roosevelt declared a state of national emergency. People and materials that otherwise would have been used for the development and manufacture of television equipment were diverted to national defense. The December 7 bombing of Pearl Harbor in 1941 brought the United States decisively into the war and put television on hold just as decisively for several years.

Color Television

Given the history of the incompatible set of low-resolution monochromatic systems in the early 1930's and the similarly incompatible set of "high" resolution systems in the early 1940's, you might think that the television manufacturers would have worked together to develop a common standard for color broadcasts.

Of course, no such thing happened. On October 11, 1950 the FCC formally adopted the field-sequential color system preferred by CBS. RCA, which preferred a different color system, sued the FCC to stop CBS's color broadcasts. The Supreme Court eventually found in CBS' favor, but the suit caused a delay in CBS's color broadcasting. During the delay, RCA continued selling their monochromatic television sets that were incompatible with the CBS standard. The new standard was not viewable on a large number of television sets. Sponsors were hesitant to advertise on the broadcasts, due to the small viewership. The color standard quickly became unviable, with CBS eventually recalling all of its color sets.

From 1951-1953, the National Production Authority prohibited the manufacture of color televisions for general distribution. This measure was suppos-

edly to conserve materials for national defense, but seems also to have been intended to clear way for a new standard.

Even while the CBS color standard was quietly dying, work was underway by a consortium of television companies on a new color standard that would be compatible with existing monochrome sets. One of the chief contributors was RCA, the company that was opposed to the CBS color standard. RCA petitioned the FCC to accept the new standard on June 24th, nearly a month before the official NTSC petition on July 22, 1953. The FCC approved the NTSC standard on December 17th, with the first broadcasts slated to begin January 23, 1954. In fact, NBC received permission from the FCC to begin broadcasting on January 1st, upon which they broadcast the 1954 Rose Parade in color using the new NTSC standard.

Europe modified the 525-line NTSC standard to be compatible with the 625-line monochrome formats being broadcast there. The resulting standard was called Phase Alternate Line (PAL). PAL broadcasts began in Britain and Germany in 1967, with each country using a slightly different version. At the same time, France developed Sequentiel Couleur Avec Mémoire (SECAM).

All three color broadcast formats are still in use today. Most countries in North and South America use NTSC. Most of the rest of the world uses PAL, although a few countries use SECAM.

Recording Devices

Early television shows were broadcast live because there was no way to record them. Once a program was broadcast, it was lost forever. Film did exist. Programs could be filmed in advance, then a live video camera pointed at the film screen for a live broadcast, but there was no way to store video. Some experimentation was done with cameras that broadcast video signals and recorded the same image onto film simultaneously.

Decades earlier in 1927, John Baird experimented with a technology he called Phonovision that recorded Baird's television broadcasts onto vinyl disks very similar to phonograph records. Although his recording system worked for the low-resolution 30-line monochromatic video he was using, it did not scale well to higher resolutions.

Video Tape Recorders

In the early 1950's, several companies began researching and developing the technology to store television broadcasts on magnetic tape. The big breakthrough came in 1956 when a company named Ampex introduced their Mark

IV Video Tape Recorder (VTR). It recorded color television signals onto open reels of magnetic tape 2 inches wide. The Mark IV was the first practical video tape recorder. The device was the size of several filing cabinets and cost $75,000. The Ampex Mark IV was used for the first delayed television broadcast on November 30, 1956.

Recording capability was a major milestone in the history of video. Programs could be tape-delayed for playback across multiple time zones. Shows could be played back repeatedly. Mistakes made during recording could be discarded. Historically significant pieces could be archived for future reference. Video footage could be edited[3].

Over the years, the VTR's became smaller and cheaper. In 1963, Sony introduced the first VTR intended for home use. Selling for $1000, it was also an open-reel system and recorded programs onto a ½ inch tape. The system was not widely popular.

Video Cassette Recorders

Open reel systems were a bit of a pain with which to deal. In 1969, Sony introduced the first videocassette. Video was still recorded onto magnetic tape, but now the reels were enclosed inside a cassette. The tape did not need to be manually threaded onto spools. This U-Matic format used ¾-inch tape and made physical handling of video media faster and easier. The format is still in use today at facilities such as schools and public-access cable studios. The machines, which used video cassettes, were called Video Cassette Recorders (VCR).

Until the mid-1970's, VCRs were professional tools and not available to the general public. Then, in November 1975, Sony introduced the first consumer VCR for $2300. The machine used videocassettes with ½-inch tape in a format Sony called Betamax. In 1976, JVC responded to Sony's offering by introducing its own VCR and tape format called Video Home System (VHS).

Betamax had better reliability, better picture and sound quality, and was cheaper to manufacture than VHS. VHS supported tapes that were two hours long, whereas Betamax tapes were only an hour long. A brief and vigorous format war ensued, with VHS eventually winning and becoming the *de facto* standard for consumer VCRs.

Discussions continue today as to why the technologically inferior VHS succeeded over Betamax. Some people feel Sony's restrictive licensing

[3] Early videotape editing was very similar to film editing, in that it required physically cutting and splicing magnetic tape. Unlike film, however, the boundaries of a single picture are not discernable on magnetic tape. Splicing in the middle of picture resulted in noticeable glitches during playback.

scheme was the blame. Some believe Betamax failed due to a lack of pre-recorded content[4]. Regardless, the battle between the formats continues to be cited whenever competing formats are proposed, as in: "DVD-RAM vs. DVD+RW could turn into another VHS vs. Betamax."

Despite its failure in the consumer space, derivatives of Betamax, such as Betacam SP and Digital Betacam, continue to be used today by video professionals. VHS continues to prosper in consumer space in both its original as well as derivative forms. PAL-VHS records PAL broadcasts. S-VHS increases the picture quality by separately recording chrominance and luminance. DVHS was briefly used to record high definition digital content from satellites systems.

Laser Discs

The picture quality of VHS is not as good as broadcast television. There is a noticeable difference between watching a television show and watching a recording of a television show. The show is typically broadcast from tape, but it is a professional system costing hundreds of thousands of dollars and not well suited for consumer use.

In 1978, Pioneer developed laser disc technology. The laser disc was a 12-inch diameter. Initially used by General Motors to train Cadillac salesmen, it was offered for home use in 1980. The picture quality was better than VHS. The sound was CD-quality and supported 5.1 Surround† sound. Yet laser discs never gained huge acceptance by consumers because they could not be recorded at home and the disc had to be flipped over halfway through a movie.

[4] One interesting theory is that VHS succeeded because the format was backed by the pornography industry.

Looking Ahead

Many broadcast and tape formats discussed in this chapter are on the verge of becoming extinct. They are being replaced by digital formats with higher resolutions and greater feature sets. However, there is half a century's worth of videotapes lying around which we will always want to be able to play. Emerging formats such of HDTV are thus riddled with legacy modes capable of supporting today's standard definition formats. Let us just be glad that Baird's Phonovision was never mass-produced or HDTV might have to support that format as well!