# Preservation & Valorisation of Audiovisual Heritage

Vectracom
VIDEO SOLUTIONS

March 2014

Welcome,

This document is intended for all those in possession of audiovisual heritage.

If it has not been digitized, as time progresses, your content becomes increasingly unusable. It degrades physically and devices for playing it become obsolete and disappear.

You often tell yourself that everything should be digitized but in reality, little is done.

It’s time to take action to rescue a legacy that is on the road to ruin.

There has never been a better time.

The technology exists, and it is mature. Apart playing equipment, it is widely available and affordable, and time has not yet completely erased your historical recordings.

Without a doubt, your audiovisual heritage has value. It’s up to you to make it profitable.

Jean-Michel Seigneur
Head of Marketing at Vectracom

# Contents

# Preservation of audiovisual heritage

## According to UNESCO, 200 million hours of video programmes are in danger of being lost.

Preserving one's audiovisual heritage means ensuring that it can be seen or heard today, tomorrow and forever.

Attitudes change. Preservation for the purposes of entertainment has long been well understood and acknowledged. Today, preservation for information purposes is becoming routine, as a matter of course. Many people now grasp the value of archives and the uses to which they may be put. But this understanding varies from one culture to another.

### Finally, a lasting solution

In the past, the copying of content onto new physical media was the main technology of preservation. Material was copied onto new media, while the old was jettisoned. Twenty years later, the same cycle had to be repeated. This technology has now been dropped in favour of digitization. We can differentiate between two types of preservation:

- Preventive preservation, which consists in keeping contents on their original media, as it stands.
- Curative preservation which consists in digitizing material under the best possible conditions.

### Preventive preservation

This consists in keeping content in an appropriate environment, one that minimizes ageing of media. It requires a keen knowledge of the media and heavy-duty resources. It is a specialist business that most owners of archive data cannot in general handle themselves, due to the high level of expertise required.

### Curative preservation

This is the only legitimate way to preserve audiovisual heritage. This technology consists in digitizing content, after correct preparation to secure the best possible transfer quality. It is now reasonable to assume that digitized content can be preserved indefinitely, providing certain precautions are taken. Also, digitization allows ubiquity of information, preserving it from disasters like it was the case during the fire at the presidency of Bosnia and Herzegovina in February 2014 where valuable archives burnt and disappeared for ever.

### A pressing matter

For anyone wishing to preserve their audiovisual heritage, digitization is a matter of urgency. Postponement only leads to the deterioration of media and makes the content more difficult to read as technologies become obsolete. The longer you wait, the more the original content degrades and the harder it is to produce good digital copies. The old magnetic media, which disappeared from the market 25 years ago, will be completely unplayable 20 years from now. Content will be irrecoverable. Quality have already diminished and the equipment used to play such media is becoming increasingly rare. The longer you wait, the more the profitability of a digitization diminishes. It is thus a pressing matter, and at the very least a strategy should be established.

*Valuable archives of Bosnia and Herzegovina burning on feb 2014 8th*

### The cost of failing to act

A failure to act has its cost. If you are keeping your content over a long period, calculate the cost along with the additional costs of preservation. Add a fraction of the initial production expenses, and you will have an idea of your potential losses when it becomes illegible. Naturally digitization is an expense, but it guarantees the long-term existence of content and above all, renders it commercially useable. Failure to act simply guarantees the loss both of content and the investment made thus far to create and preserve it.

*The urgency is different depending on the media*

## Developing a strategy

The most pressing matter is to gauge the condition of archive data and develop a plan of action that will enable you to make an informed decision.

Do not wait a second longer. Instigate an initial strategic action plan. Either work alone or seek help from specialized consultants. Imagine different scenarios and estimate costs.

## Move forward with precise data

The need to finalize a plan to present to decision-makers and thus obtain financing calls for clarity and assurance with regard to feasibility, available means, and costs incurred. For that you need to put your faith in the people who know because they have been there before; someone with real knowledge and proven experience of preservation and digitization of audiovisual archives.

## Time is running out

The longer you wait, the more the preservation of your archive data is going to cost you. And technology is not about to come to your aid. Old media perishes. Urgent action is required.

### Vectracom services

- Leader of audiovisual heritage preservation
- Dedicated to audiovisual professionals
- More than 20 years of concrete practice
- Expert in the entire range of technologies for digitizing and restoring legacy audio, video and film recordings
- All required legacy equipment in stock
- Range of services from consulting to turn
- key projects
- Range of certified solutions to manage from
- very small to very large volumes of media
- Ability to manage projects at your location
- Detailed plans and quotes on request
- ISO 9001 certification


*Few art forms have appeared and disappeared as rapidly as silent movies. 75% of American silent films have been lost. Without preservation, an irreplaceable heritage has gone forever.*

The same applies to all audiovisual content existing only on magnetic tape. Within a few years it will exist no more.

The World Day for Audiovisual Heritage is an initiative of UNESCO. It commemorates the adoption by the 21st General Conference in 1980 of the recommendation for the safeguard and preservation of audiovisual heritage. It is an opportunity to draw public attention to the need for urgent measures and to acknowledge the importance of audiovisual material.

# Film

Kodak closed its film division in 2012, while Fuji officially stopped the manufacture of film stock in March 2013. Important Hollywood studios themselves ceased providing 35mm copies in 2013. Increases in the cost of film allied to a fall in the price of digital equipment rapidly justified the film industry's decision. From that point on, specialist companies, equipment and know-how began to disappear. Very few remain.

## A heritage in great danger

Audiovisual heritage consists mainly of optical film (8mm, 16mm, 35 mm and all other types covered in the current chapter). Almost every institution in the world possesses film archives. But film stock ages and perishes. Chemical attack, mechanical deformations and shrinkage, changes in elasticity and «vinegar syndrome» are all problems exacerbated by poor storage conditions.

In the USA, already more than 75% of the early silent films have been completely lost. Among art forms, the speed of the rise of silent movies and their subsequent disappearance is unprecedented.

If nothing is done, an entire heritage is going to vanish. The equipment capable of reading film is going to become increasingly hard to find, and the films themselves will vanish into dust unless their preservation is assured.

There are many types of film formats. We have listed the most common ones here.

*Archived films at Vectracom*

| Year(s) | Name | Film | Perforations | Use |
|---|---|---|---|---|
| 1900 | Micrograph | 20 mm in black and white | On 1 side | Amateur |
| 1900 | Pocket Stopwatch | Black and white | Central | Amateur |
| 1912 | Pathé Kok | 28 mm B&W non-inflammable | Central | Family Cinema |
| 1922 | Pathé Baby | 9,5 mm; sound from 1930 | Central | Amateur |
| 1927 | Pathé Rural | 17,5 mm; sound from 1933 | Central | Country |
| 1927 | Cellfilm | 22 mm ozaphan film | On 1 side | Country |
| 1929 | Cinélux | 22 mm ozaphan film | No perforation | Country |

*Some of the numerous early film types*

## Early films

The first films appeared in 1888. Manufactured by George Eastman, they were made from cellulose nitrate and were 70mm wide. In 1891, William K L Dickson created the 35mm film, with 4 perforations. At that time, he worked with Thomas Edison. This format was subsequently used in cinema and for the shooting of pretty much all fictional work. Early films were silent and in black and white. In this period, manufacturers produced many films of every type. They have considerable heritage value.

*Super 8 cartridge*

## Most common formats

In 1923, Kodak launched 16mm as an alternative to 35mm. Economical and lighter, it became the professional format for news reports and fiction on tele vision. It originally had perforations on each side but the appearance of talkies introduced the addition of a sound strip (magnetic or optical) and generalized the use of film with perforations on one side only.


*16 mm with optical soundtrack*

Super 16 is a version of 16mm with a 1.66 aspect ratio, better suited to 16/9 video transfer and enlargement to 35mm. Kodak launched 8mm in 1932, then Super 8 in 1965 for amateur cinema. The perforations in Super 8 are

*35 mm with optical soundtrack*

smaller, producing a superior quality enlarged picture. Sold in a cartridge, Super 8 film was much easier to handle. It is the most widely used format among amateurs. Surprisingly, 8 and Super 8 were only available in sound versions between 1974 and 1997, after which they became silent again

Offering a good balance between cost and quality, 35mm has stood the test of time. Designated an international standard in 1909, since that time it has been the basis of several picture formats of different width and height. Mostly used in aspect ratios (width/height) of 1.33 and 1.85, it was also chosen by 20th Century Fox in 1953 for its cinemascope format, boasting an aspect ratio of 2.39. The Vistavision format, launched by Paramount in 1954, used the 35mm with an aspect ratio of 2.55. In the latter format, the film rolled longitudinally rather than laterally. In the years following the Thomas Edison era, film had sound added, became non-inflammable and developed colour. It is also the format adopted for photography. Super 35 is a format that uses 35mm film but offers a larger viewing area thanks to the use of space usually reserved for the optical sound track.

## Large formats

70mm was popularized in the 1950s, after a few attempts in the 1930s, mostly thanks to a renewed enthusiasm for large formats after the arrival of television. 70mm is still used by the IMAX process, as well as by more confidential formats intended for amusement parks.

70mm Panavision uses 6 magnetic tracks located on either side of the picture.

## Films are composite material

Film stock is a composite material made up of a substrate covered with a binder holding the particles that form the picture or sound. Hence the film mostly consists of:

synthetic part, which is the substrate. These substrates have evolved over the years - cellulose nitrate, diacetate or tricetate; polyethylene terephthalate (PET), polyethylene naphthalate (PEN). Also polyvinyl chloride (PVC) for magnetic tape.

- A mineral part, which constitutes the emulsion - the active element on which is recorded the picture or sound.
  - For picture, **silver salts** very sensitive to hygrometric variations and pollutants, notably sulphur
  - for magnetic tapes, **iron or chromium oxides**, sensitive to hydrolysis and to acids.
- An organic part - the binder - made from extract of putrescible animal matter and sensitive to the mould that keeps the mineral part in suspension.
- A lubricant, which ensures the smooth running of magnetic tape. This contributes to their deterioration by leaving a deposit on tape heads.

Substrates have evolved over time, most notably graduating from inflammable substrates, known as «flam», made from cellulose nitrate, to less dangerous substrates known as «safety», which are equally as perishable.

| Name of substrate | Cellulose nitrate | Cellulose triacetate | polyester film |
|---|---|---|---|
| Label | «Flame», «Flam», «Nitrate». Sometimes unmarked. | «Safe», «Safety», «Non -Flam» | |
| Period | 1880-1953<br>1858 fro photographs | Existed since 1920<br>Obligatory from 1953 for copies<br>Continued use in filming | PET from 1952<br>PEN from 1996 |
| Formats (mm) | 75 / 70 / 35 | 35 / 16 / 9,5 / 8 and super8 | All copies |
| Deterioration | Self decay, darkening, stickiness, becomes dusty then self combustible at 40°C<br>Risk of mould | Self decay, does not perish but crinkles, shrinks and emits acetic acid (Vinegar syndrom) - a contagious condition.<br>Risk of mould | No deterioration (100 years lifespan at 21°C and 50% RH)<br>Risk of hydrolysis and low shrinkage.<br>Possible detachment |
| Recognition test | intense blue coulour in diphenylamine acid solution<br>Runs in trichlorethylene. | Vinegar odor.<br>Floats in the trichlorethylene | Remains in suspension in trichlorethylene.<br>Birefringence. Fiber optic effect |

# Storage and restoration of films

## Storage of film archives

The most important face of protecting film is to store it in an environment as cool as possible, but one that is neither too humid, nor too dry. The major Hollywood studios and other big organizations with large film archives have built storage facilities with controlled temperature and humidity to preserve their film.

The life expectancy of media diminishes with increases in temperature, hygrometry and the fluctuation of same.

The table drawn up by the Image Permanence Institute at the Rochester Institute of Technology, gives an idea of the life expectancy of stocks according to environmental conditions of conservation.

*Archived films at Vectracom*

This table indicates, in red, conditions in which there is a high risk of the proliferation of mould, which must be isolated and removed when detected.

Climatic stability is the first objective. The 2003 ISO 11799 standard concerning long-term storage requirements for archive and library materials, indicates the temperature and degree of hygrometry recommended according to types of magnetic tape. Basically, on average, a low relative humidity (35%) is required, along with a temperature lower than, or equal to, 12°C. But it is not that straightforward. Maintaining low hygrometry and low temperature is a complex business. It follows that there is a catastrophic risk of breakdown and condensation.

| expected life(years) | | Temperature | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2°C | 7°C | 13°C | 18°C | 24°C | 29°C | 35°C |
| Wet Level | 20% | 1250 | 600 | 250 | 125 | 60 | 30 | 16 |
| | 30% | 900 | 400 | 200 | 90 | 45 | 25 | 12 |
| | 40% | 700 | 300 | 150 | 70 | 35 | 18 | 10 |
| | 50% | 500 | 250 | 100 | 50 | 25 | 14 | 7 |
| | 60% | 350 | 175 | 80 | 40 | 20 | 11 | 6 |
| | 70% | 250 | 125 | 60 | 30 | 16 | 9 | 5 |
| | 80% | 200 | 100 | 50 | 25 | 13 | 7 | 4 |

*life expectancy according to conservation conditions*

*Cleaner at work*

## Restoration of films

To be correctly preserved, either by storage in an appropriate environment or by digitization, film must first be prepared by a process of mechanical repairs. This is not a straightforward operation, rather a specialist task requiring a great deal of expertise and know how, carried out by qualified restorers. Great care is needed. An operator restores only a few meters of film per day, with the length varying according to the physical state of the film.

Repairs include mending perforations and breaks, regluing, joining together reels and synchronizing pictures with sound.

The film has to be cleaned, and any old adhesive (scotch tape) used during mechanical editing needs to be replaced. In addition, old adhesive waste must be eliminated.

It is a rather laborious job as it requires the use of solvents, meaning that operators need workstations equipped with special extractor hoods connected to a ventilation network. Operators search for scotch tape by manually running the film

on editing tables and physically scanning for joins by pinching the film between gloved fingers. Depending on its resistance, the removal of old scotch tape is carried out using any one of a number of techniques, often by immersion. Scotch tape leaves visible traces on the film, and work is required to remove any trace of adhesive.

## Cleaning film

The cleaning of film consists in removing any remaining particles of dust. It is the final operation in the preparation phase of preservation, whether by storage or by digitization. Cleaning can be carried out by hand, on a machine fitted with cloths, or in a machine that treats film by ultrasound in a bath. The latest is recommended.

*Operator using ultrasonic cleaner*

### Handling and packaging of film

Touching the surface of film must be avoided at all costs. The wearing of gloves is an indispensable precaution for handling any archive data. Reels of film are always handled vertically. The handling of perished film is a job for specialists. The working area must be exceptionally clean and dust-free. Film or tape must not be dragged across the floor. The winding of film is a key process. It must be done using undistorted reels on a hand operated viewer. The risks of distortion means that tension during winding must be neither too slack nor too tight. The lead-in section needs to be correctly fixed.

Cleaned film must then be put away in boxes to protect it from anything that might decompose and form dust: paper, blotting paper, humidification systems, cardboard, paper bags, sleeves, plastic bags, paper clips, etc. And if any boxes contain media affected by vinegar syndrome, it must be thrown out. Boxes must also allow air to circulate and any internal pollutants to be evacuated.

### Vectracom services

- On-site restoration , or in Vectracom premises
- Any type of film, mostly 8mm, 16mm and 35mm
- Analysis of films storage condition
- Cataloguing of films
- Handling and safe transport of film reels
- Mechanical restoration (regluing, edge repair) 20 workstations equipped with machines
- Assembling of film reels
- Synchronization of picture and sound
- Complete cleaning (brushing and ultra-sound)
- Repackaging
- Labelling according to heritage standards
- Constitution of film sheets
- Collection and transformation of metada-ta
- Ongoing reporting with workflow mana-ger

Boxes are lined up horizontally for films and vertically for magnetic tape. The original metal boxes are usually avoided because they rust. Boxes made from chemically stable plastic materials are recommended.

After an extended storage (2 years), it is necessary to slowly rewind magnetic tape completely.

*Operator on veiwing/editing table*

# Digitization of film

Digitization ensures the preservation of the content of optical film or magnetic tape. Digital data promises better durability. Content is also more easily commercialized. But digitization requires true mastery of the hardware, as the content must be respected at the moment of transfer. The digitization of film is performed by telecine or via a scanner.

*Telecine mechanism*

Telecine (TC) transforms film into digital video signals, which in turn can be turned into files. They work real-time in SD or in HD (25 or 30 fps) in an aspect ratio of 4/3 or 16/9, depending on the format of the original picture. Colour correction can be performed at the same time as the transfer. Telecine handles damaged (shrunken copies or collages) film comparatively easily. The use of a wet gate helps reduce the visibility of scratches.

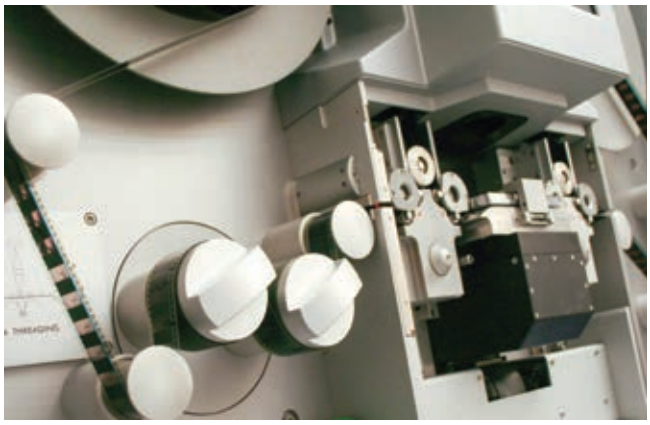
| | SD | HD |
|---|---|---|
| Definition - pixels | 720 x 576 | 1920 x 1080 |
| Frames per sec (50Hz) | 25 | 24 / 25 / 50 |
| Aspect ratio | 4/3 or 16/9 | 16/9 |
| Mode | Interlaced | Interlaced or progressive |

*Usual supported standards*

1,85:1 film in a 4/3 telecine output ---> letterbox

1,33:1 film in a 16/9 telecine output ---> pillar box

The use of telecine is preferred when content is digitized for broadcasting purposes because it often needs to be colour corrected and restored. Calibration costs are reduced if carried out during or after digitization. Restoration can be also be carried out cost effectively using restoration tools in real time or at digital stations. Scanners are machines allowing film to be scanned and stored in file form.



*Scanner mechanism*

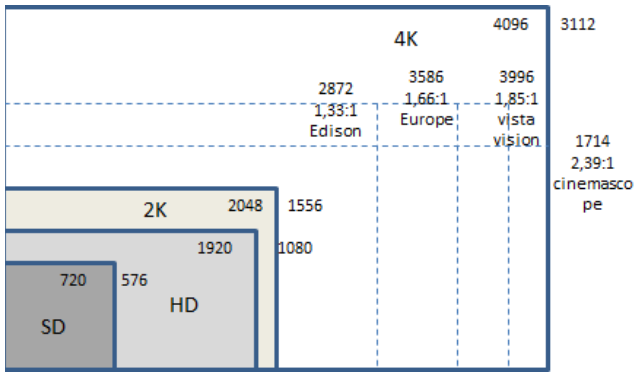
A scanner produces very high resolution output. A suite of pictures is recovered.

Horizontal resolution is fixed, regardless of the original format. Vertical resolution is dependent upon the format of the film (square pixels).

| | | Definition | hrz Pixels | vrt |
|---|---|---|---|---|
| Film aspect ratio | 1,33:1 (academic) | 2K | 2048 | 1556 |
| | 1,85:1 | 2K | 2048 | 1880 |
| | 2,31:1 | 2K | 2048 | 816 |
| | 1,33:1 (academic) | 4K | 4096 | 3112 |
| | 1,85:1 | 4K | 4096 | 2160 |
| | 2,31:1 | 4K | 4096 | 1714 |

*Usual definitions on scanners in 2013*

Scanners generally operate more slowly than real time (this is in 2013). The greater the resolution, the slower the job.




*Usual moving pictures definitions*

Colour correction is carried out after the scan, using specialized equipment. Scanners are used when preservation is the only purpose.

Sound can be on the film itself, meaning it is optical, although it may reside on a magnetic strip, as is the case in Super 8.

It may also be on a separate tape, usually a magnetic

| Equipment | Telecine | Scanner |
|---|---|---|
| Advantages | Speed, price. Preferable for immediate use, e.g for broadcasting | Image definition and stability<br>Preferred for preservation without immediate use |
| Disadvantages | Video format 1/3 or 16/9 | Cost and duration fo operations<br>Very large files |

*Operations on HD Telecine*

recording. If it is optical and resides on the film, it is read by the telecine or scanner. More often, sound digitization is performed in a second pass, during a 2nd phase. When it is on a separate magnetic tape, suitable playback equipment is employed to synchronize sound with the telecine or scanner, whichever is being used.

## Film to use

When film content is to be digitized, the very best quality available must be used. For example it would be a shame to work from a broadcast copy if an original negative or an intermediate copy is available. The initial resolution of a copy does not have the same definition and never gives an identical result, even if it is acceptable.

## For which resolution to opt for digitization

When studying optical transfer functions of movie cameras, films and scanners or telecine lenses, it appears that a 4K scan is perfectly suitable for the digitization of content from a 35mm camera negative film. Such definition is neither too strong nor too weak. No additional information would be captured using a higher resolution.

For 16mm negatives, the same reasoning applies with digitization in HD or 2K. Digitizing at a higher definition is a pointless exercise, and 2K offers practically nothing more than HD. More, its use is often inappropriate.

By the same reasoning, SD resolution is sufficient for 8mm film.

Higher resolutions only increase the cost without improving the end quality. This reasoning is valid for original camera negative film. But available copies are often several generations from the original and their quality markedly reduced. It is therefore pointless and unsuitable to capture in too high resolution because it only costs more, complicates the process, introduces more noise and produces larger files.

### Vectracom services

- SD and HD Telecine and 2K scanner
- All types of safety films (negative, positive)
- Any type of film, 8mm, 16mm, 35mm, etc
- Embedded or separate audio
- Optical or magnetic audio tapes
- Best light operations for preservation
- Color grading by senior colorists
- Simultaneous restoration in real time
- DPX or any video format

*Operator using an audio film scanner*

# Sound recording

Two techniques have been used: mechanical recording and electrical recording - initially analogue, then digital.


## Cylinders

Mechanical engraving was the first technology used to record sound. From 1880, sound information was carried in the form of grooves, cut onto the surface of a cylinder. Variations are directly proportional to the sound waves. The early cylinders were made of cardboard covered with tin. Directly engraved by a needle under sound pressure operated via an entirely mechanical device, the first recordings were priceless, more so because until 1895, it was impossible to copy them.

With an equipment specially designed, these cylinders can still be played today. Problems arise from deterioration of the medium over time and repeated playing.

## Shellac discs and long plays

Discs appeared in 1888. They adopted the principle of cylinders only in a more easily reproducible form. The initial 90 revolutions per minute gave way to 78 rpm in the twenties. Made from «shellac», they measured 25 to 30cm for a 3 to 6 minutes recording. They could be either cut directly or pressed. The concept involves the use of a playing stylus under heavy pressure, which damages the grooves with every pass, increasing crackle and background noise. It's also worth noting that the 78 rpm of the players used at the time was very approximate.

Vinyl replaced shellac in the forties. Discs were then known as «long plays». Vinyl enabled both the length and quality of recordings to be increased, notably through an increase of bandwidth and a reduction in surface noise. In 1954, the RIAA (Recording Industry Association of America) specified the RIAA standard. It was rapidly adopted by producers and publishers all over the world. Three types were established: the 33rpm LP, the 45rpm single and the 45rpm maxi single.

Initially recorded in mono, they became stereophonic in the sixties and quadraphonic in the seventies. They age less rapidly than 78 rpms.

The playing of discs is comparatively straightforward but it must be stressed that the restored quality depends a great deal on the equipment and method used. Particular attention must be paid to the digitization of discs which are being played for the last time during this operation. It would be a great pity not to take the opportunity to achieve an excellent reading of the recording, with the best available equipment in each case).

## Compact discs

This is an optical optic, 12cm in diameter, read by laser. Created by Philips and Sony, it was first marketed in 1982 to replace the LP record. Its characteristics are defined in the Red Book. It enables 74 minutes of music to be recorded in 16bits/44.1 kHz.

## Magnetic recordings

In 1898 Danish engineer Valdemar Poulsen invented the first process for the magnetic recording of information, the forerunner to tape and videocassette recorders. It used a wire. During the 1900 World Fair, he used his process to record the voice of Emperor Franz-Joseph of Austria. It is, to this day, the oldest magnetic sound recording. The quality of recording was restricted but it was used until the thirties, when it was superseded by Jerry Pfleumers magnetic tape, invented in 1928. This brought a great improvement in quality. This flexible tape was between 1/4'' and in 2'' large. Produced first in acetate, then in PVC and polyester, it had a coating containing tiny magnetic particles of iron, chromium or pure metal.

## Analogue technology

¼'' open reel

In professional use, tape runs at 19, 38 or 76cm/sec and is not reversible. Recordings are mono, two-tracks or stereo. According to the country of origin, the recording standard (NAB, IEC, UK) changes. The correct standard with the right equalization must be used during reproduction. Reels are 9, 18 or 27cm in diame-

*¼'' open reel*

ter. Recording times are directly linked to speed of reproduction, spool diameter and thickness of tape.

Recording and tape quality are directly linked to running speed. Widely used in radio, this medium can be edited using scissors.

In use by the general public, recordings are mono or stereo (4-track tape). The tape is turned over to be played the other way round, thus doubling the length of recording. Used at lower speeds of 4.75, 9.5, 19 or even 38cm/sec, the format greatly appreciated by enthusiasts from the 50s through to the 80s before being gradually replaced by the Philips «compact cassette».

### ½'' open reel

This format was mostly used in radio and recording studios for masters and multi-track recordings (8 track).

### 1'' and 2'' open reel

Used in recording studios, the tape has from 8 to 48 tracks allowing separate recording of individual instruments.

*1'' open reel*

### Audio cassette

Invented by Philips in 1963, it uses 3.81mm-wide tape running at 4.75cm/sec. Initially in mono, later in stereo, its quality improved with progress in electronics and metal oxides (iron, chromium, metal) such that by the 80s it was comparable to open reel quality.

Used by the general public, then by professionals, who appreciate its size and ease of use, particularly during field recordings. The arrival of Dolby and DBX noise reduction systems further improved performance.

*Audio cassette*

Total recording time for both sides could be as much as 120 minutes.

### Audio cartridge

Developed in the early 60s, the audio cartridge contained a 1/4'' stereo, multi-track tape.

It disappeared sometimes in the 80s. Some producers manufactured their own cartridge standards, such as ELCASET, but they met with little success.

## Digital technology

### Open-reel tape

Two main formats existed side by side.

- ☼ The 1⁄4'' DASH format was introduced by SONY in 1982, producing with 16 or 24 bits uncompressed 24 or 48 tracks digital recordings, usually in 44.1 or 48 kHz. It was used almost exclusively in studios.
- ☼ The PRODIGI format was introduced by Mitsubishi in the mid-eighties, producing 16 or 24 bits uncompressed 16 or 32 tracks recordings in 44.1 or 48 kHz on a 1⁄4'' to 1'' tape.

## Vectracom services

### A complete offer

- Transfers performed either on site or in
- Vectracom workshops
- Detailed examination of a complete archive
- Tapes and cassettes repair
- Cleaning and baking with appropriate parameters
- Repackaging
- Labelling according to heritage standards
- Establishment of tape sheets
- Collection of data with transformation into
- technical metadata
- Ongoing workflow management

### A large range of audio players

- Clement professional turntables
- More than 60 professional Studer or
- Schlumberger 1/4'' players
- More than 20 audio cassette players (Tascam,
- Denon, Sony)
- More than 12 DAT players (Sony, Tascami,
- Panasonic)
- 24 tracks analogue recorder Otari MTQ 90
- 32 tracks digital recorder Mitsubishi X850
- 24 tracks digital recorder Sony PCM 3324
- 48 tracks digital recorder Sony PCM 3348 HR
- U-Matic digital recorder Sony PCM 1630

# Digitization of sound recordings

## Digitization of vinyl discs

The quality of digitization of signals initially recorded on mechanical media is dictated by the quality of playback equipment, the type of stylus in the groove, and the quality of filters and preamps.

Discs must always be cleaned prior to playback. A special solution is used. Humidification of a disc may minimize crackle.

The playing stylus chosen is dependent upon the disc. For optimum results, 78 rpm discs are played with diamond styluses specially adapted to the size of their broad grooves. For long plays, standard diamonds are used. The turntable must be of professional quality.

Automatic production of digital files from recordings on discs is a relatively straightforward operation. Crackle can be alleviated, but care is taken to always keep a copy of the original recording before restoration.

End of page 16 - Sound recording

### Ephemeral formats

A few ephemeral formats that used video recorders first appeared in the 80s, such as EIAJ, for use by the general public, and EIAJ, for use by professionals. Recordings are uncompressed 16 bits, in stereo. In 1991, ADAT (Alesis Digital Audio Tape) used VHS tapes to produce recordings with up to 8 tracks. In 1993, DTRS (Digital Tape Recording System) used Hi8 tapes to record 16 or 20 bits digital audio recordings with up to 8 tracks in 44.1, 48 or 96 kHz for radio and private studios.

### DAT

*Digital Audio Tape*

Introduced at the early of the eighties it used a 3.81mm wide tape protected by a case, slightly smaller than an audio cassette. It recorded stereo 16 bits (20/24 bits in certain versions) sound in 32 Khz, 44.1 Khz, and 48 Khz in certain versions. With its two running speeds, it was used both by the professionals and the wider public thanks mainly to two ranges of completely compatible machines.

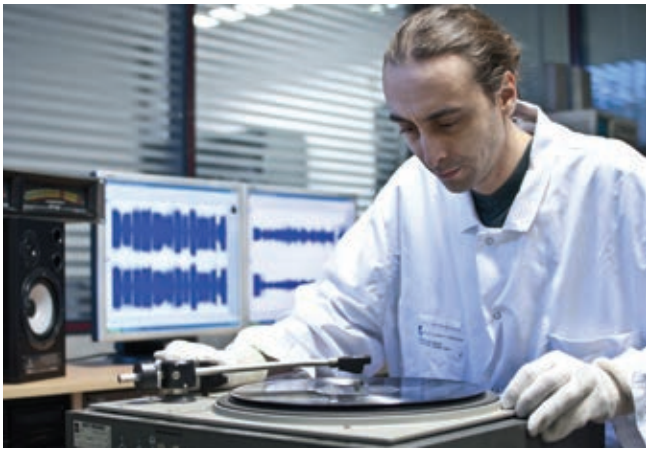
### DCC (Digital Compact Tape)

A format introduced in 1992 by Philips, it allowed digital recordings on a cassette tape of identical size to the analogue version. It met with only limited successes and was soon abandoned.

### MINIDISC (MD)


*Minidisc*

This format, introduced in 1992 by Sony, used a disc protected by a case. Recordings were made using a magneto-optical process. Harnessing ATRAC compression, similar to MP3, it was used by both the general public and by professionals, for interviews and other field recordings. From 2003, players came with a USB port.

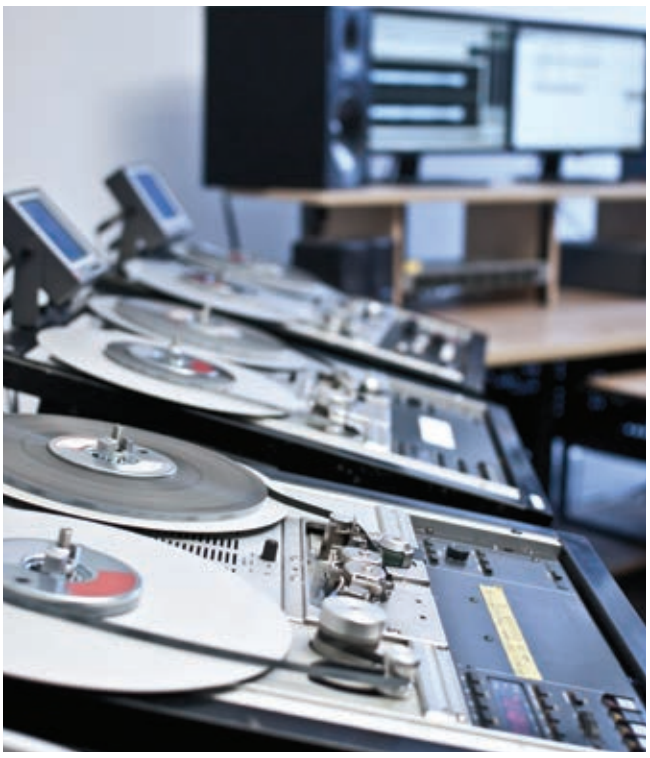

*Vinyl digitization on Studer EMT 938*

## Digitization of magnetic tapes

The quality of digitization depends on the machines used, and on the quality and adjustment of the heads. The mechanical adjustments made in the area of the heads are crucial.

For each magnetic tape, the azimuth of the head must be adjusted to reproduce the precise recording conditions and recording levels. Sometimes we have reference signals (1000Hz), but it's quite rare. Analogue/digital converters (ADC) must be of good quality.

Excellent converters are now available, and PCM digitization can be undertaken with large quantization (32 bits) and sampling frequencies of 96 kHz (96,000 samples a second) or more. In practice, given the limitations of analogue recordings, 24 bits/48 kHz is recommended for professional musical recordings, with 16 bits for interviews, etc.


*Parallelized digitizating operations*

## Modification of playback speed

Magnetic tape is usually recorded at a speed of 19cm/sec, but in reality it is often 9.5 cm/sec or 38 cm/sec. It must be played at the nominal speed. Nevertheless, when a large number of recordings is concerned, it is possible to read tapes faster and compensate with over-sampling.

This technique is quicker, and can be used for the slower speeds used on recordings of interviews, but not music. Its use is thus limited and generally avoided in the case of valuable sound archives.

## Large sound archives

To digitize large volumes, several transfer chains are used. There are specialized automations which provide effective control of digitization campaigns. In general, an automation system assists an operator in managing from 3 to 8 transfer chains in the case of long, open reels.

For the digitization of compact cassettes, the azimuth adjustments are less sensitive, and it is possible to further increase the number of chains working in parallel.

## Multitracks tapes digitization

This is usually a case of recovering original recordings in which each instrument has been captured individually, either during a concert or in a studio.

Original recording in 16, 24, 32 or 48 tracks may be analogue, but they are often digital. The job consists in transferring recording and transforming them into Protools projects. The sound can then be remixed.

*Multitracks tapes digitization*

*Azimuth adjustment on Studer A810*

## Vectracom services

- Parallel digitization with up to 8 channels under the control of automation systems
- Transfer of multitracks recordings (analog and digital) into “Protools” projects
- Maintenance and adjustment of players
- Automatic QC on all files, and validation by operators
- Standardization of sound levels
- Creation of technical metadata about original media and transfers
- Automatic detection of silences
- Tape reparation, cleaning and baking

## Video recorders appeared in the 50s.

With video tape recorders, television pictures could be recorded on magnetic tape to then be broadcast in their initial format. Prior to that, film was used. The vast majority of professional production used this mode of recording in the 60s. First, VTRs used tape reels, serving as a replacement for motion picture film stock and making recording for television applications cheaper and quicker.

Then, tape was included within a video cassette, which was used with Videocassette recorders (VCR). It came then in the 80s on the consumer market.

*Operations on 1 inch B from Bosch*

## A multitude of formats

Video recording formats sprang from a range of technological developments. There are a great many, partly because of rapid technological advances and partly because of the economic wars waged by the major manufacturers (Sony, Panasonic, Ampex, Philips, Thomson) during the latter part of the 20th century.

Each new format needs a specific machine for playback, meaning special equipment had to be created. And each were, with a few rare exceptions, incompatible with the older formats. Thus an impressive number of machines came onto the market, with each format having a rather limited lifespan.

Today pretty much all equipment playing magnetic tapes has disappeared from the market. The tapes are now only playable via specialist outlets.

*A collection of bygone video recorders*

## Preservation of VCRs

The upkeep of existing machines is a real challenge. Current manufacturers can neither produce them, nor even provide maintenance for their older models. Maintenance is now a job for enthusiasts and, for certain formats, it is impossible to find the spare parts that are required for their maintenance.

Vectracom boasts an impressive array of equipment.

All machines are used exclusively for service. They can thus be used to safeguard the heritage of a large number of institutions. Their upkeep represents a veritable challenge, one that is met by the company's technicians.

*Operations on quadruplex TR-70 from RCA*

## A few specialists

Not many specialists have the range of equipment to work on any format. Not many have the opportunity to work in PAL, SECAM and NTSC.

Usually, specialists focussed on one or two formats

At Vectracom, we are not specialized. Projects pushed us to work more on old video tapes like 2inch, 1inch, EIAJ and U-Matic (all types) and also on large volumes of more recent tapes like DVCAM, DVCPro and Betacam (all types)

*EIAJ video tapes require great attention*

## Preservation and creation of other tools

The treatment of old tapes implies reparation, cleaning and restoration. Reparation is manual but cleaning and restoration involve the use of cleaning and heating machines.

In most cases, such equipment has also disappeared. To supplement the lack and sometimes also because existing devices don't respect enough old tapes, new machines have to be designed. This is quite often the case at Vectracom to better clean tapes. We build efficient cleaning machines to preserve tapes and sometimes to include them in cart machines when large volumes are concerned.

For baking, industrial ovens with good temperature regulation are preferred.

*Operations on 2inch cleaning machine*

## Vectracom services

- 12 x 2" inch VTR (VideoTape Players)
- VTR 1''A, 8 VTR 1''B, 10 VTR1''C
- 20 x analogue Betacam VCRs
- 20 x digital Betacam VCRs
- 20 x U-Matic / BVU VCRs
- 70 x VHS / S-VHS VCRs
- 12 x EIAJ VTRs
- 10 x DVCAM / DVC Pro VCRs
- 10 x D1 VCRs (and double D1 equipment)
- 2 x D2 VCRs
- D3
- D5
- HDCAM and HDCAM-SR VCRs XDCAM drives
- 20 machines for other rare formats

*Partial equipment (January 2014)*

*Operations on quadruplex AVR2 from Ampex*

## Tape and videocassette formats

In the next two pages, you'll discover a classification of these formats. We defined 3 groups and listed main formats by chronological order. Such classification is arbitrary because recording formats have more to do with the planned use of content than the profession of the end user. Broadcasters have always used both institutional and consumer formats in their assignments.

# Video recordings

XCAM disc

HDCAM Cassette

DVCAM Cassettes

Digital Beta Cassette

MII Cassette

Betacam Cassette

1 inch tape

| | |
|---|---|
| 2003 | **XDCAM** - Sony<br>**HDCAM SR** - Sony |
| 2000 | DVCPRO HD DVCPRO P<br>Panasonic |
| 1999 | **HDCAM** - Sony |
| 1997 | DVCPRO 50<br>Panasonic |
| 1996 | DVCAM<br>Sony |
| 1995 | DVCPRO<br>Panasonic |
| 1994 | **Betacam SP UVW**<br>Sony |
| 1993 | **Digital Betacam**<br>Sony |
| 1991 | **Betacam SP Low cost**<br>Sony |
| 1988 | **D3** - Matsushita |
| 1987 | **D2** - Ampex<br>**Betacam SP** - Sony |
| 1986 | **MII**<br>**D1** |
| 1981 | **Betacam** - Sony |
| 1976 | **1''C** - Ampex<br>**1''C** - Sony |
| 1975 | **1''B** - Bosh |
| 1959 | **2''** - Toshiba |
| 1956 | **2''**- Ampex |
| 1954 | **2''** - RCA |
| 1954 | **2 pouce** - RCA |

## Professional formats

Formats referred to as «professional» are those originally intended for TV broadcast.

1954: 2-inch «longitudinal» recording by RCA.

1956: 2-inch «transverse» recording by Ampex.

1959: 2-inch «helicoidal» recording by Toshiba.

1975: 1 inch B by Bosch Fernseh runs at 24 cm/sec with 2 heads recording segments of frames with 52 lines.

1976: 1 inch C by Ampex and Sony, running at 24cm/sec with a drum rotating at a speed of 50 r/sec and including a head that records one frame per revolution. Its design makes it suitable for freeze-frame and slow-motion.

1981: Betacam by Sony, uses the same tape as Betamax (1/2'' tape). Records using 2 tracks per field, or 4 tracks per frame. The format of choice for journalists, Betacam enabled the development of the professional camcorder.

1986: MII by Panasonic. Uses a 1/2'' metal tape cassette for recordings of up to 3 hours (180 min) , comparable to the more widely used Betacam SP.

1986: D1 by Sony, based on the 4:2:2 (CCIR 601) standard, using helicoidal recording on a 19mm tape , delivered in cassette.

1987: D2 by Ampex - Composite PAL or NTSC record. Uses same cassettes as D1 but with metal tapes for the first time.

1987: Betacam SP Magnetic 1/2 inch tape cassettes made from metal (iron, nickel or cobalt) whose properties ensure performance superior to traditional oxide tape, reaching 5.5 MHz (against 4 MHz for Betacam). Length of recording can exceed 90'. Sound is recorded in FM. Drum rotates at 25 revs a second.

1988: D3 Matsushita digital composite on 1⁄2-inch tape.

1991: Betacam SP Lowcost (PVW) by SONY - On 1991, bandwidth luminance 5.5MHz, chrominance 2MHz, 2 longitudinal audio tracks (Dolby C).

1993: Digital Betacam by Sony. Uses a tape format similar to Betacam, only with metal tape

1994: Betacam SP (UVW): uses metal tape.

1995: DVCPRO Panasonic

1996: DV Pro (Digital Video Pro) or DVCAM by SONY, 1⁄4 inch tape ill-suited to difficult filming conditions, more suitable for institutional use. Same as DV but more reliable.

1997: DVCPRO 50 by Panasonic

1999: HDCAM Records images of 1920 pixels in 1080 lines. Can be recorded at different frame rates, in progressive or interlaced mode (24p, 25p, 30p, 50i, 60i).

2003: HDCAM SR by Sony. High Definition digital format

in native 16/9, 1920x1080 (MPEG4 compression, Studio Profiles / 600 Mbit or 800 Mbit/sec). Remains exclusively used by digital cinema and advertising, due to cost.

2003: XDCAM. Blue laser used by SONY to record audio and video content on professional 12 cm discs, of 23.3 GB or 50GB in dual-layer format, similar to Blu-ray. Depending on the recorder, the compression format is DVCAM or IMX.

*Hi 8 Cassette*

*S-VHS Cassette*

*U-Matic Cassette*

*EIAJ tape*

| | |
|---|---|
| **1996** | DV - Sony<br>**D8** - Sony |
| **1995** | **Hi8** - Sony |
| **1994** | SVHS |
| **1988** | **BVU SP** - Sony |
| **1978** | **BVU** - Sony |
| **1972** | **U-Matic** - Sony |
| **1969** | **EIAJ** |

*MiniDV Cassette*

*Vidéo 8 Cassette*

*V2000 Cassette*

*VHS Cassette*

*Betamax Cassette*

| | |
|---|---|
| **1996** | DV - Sony |
| **1995** | **Video8** - Sony |
| **1979** | **V2000** - Phillips |
| **1976** | VHS<br>**Betamax** - Sony |

## Corporate formats

EIAJ: The first non-professional format for the recording of video signals. Initially black and white, it evolved into colour.

U-matic, BVU and U-matic SP: Created by Sony, also in the catalogue of Matsushita and Thomson. It stands at the border of the «broadcast» and «non-broadcast» worlds, notably in its SP versions, recording composite video signals. More than a million machines were installed across the world. It used 3⁄4 ''oxyde tape. With a horizontal resolution of 250 lines for luminance, it was the format of choice for the institutional sector, as well as broadcasters in its BVU version with 300 lines.

S-VHS (super VHS): Developed by JVC and Panasonic, based on VHS, it had 400 lines of horizontal resolution and two longitudinal audio tracks (Dolby B) plus two frequency-modulated hi-fi audio tracks recorded by the rotating heads.

Hi-8 (8 mm high-tape): Developed by Sony and other Japanese manufacturers, this was to 8mm what S-VHS was to VHS.

DV (Digital Video): Developed by SONY, DV is a video recording system using digital data. It ensures a superior image rendering in terms of brilliance, definition and colour.

## Consumer formats

Two main types of equipment were marketed : Homes VCRs with a tuner to record TV programs and camcorders.

Betamax: by Sony in the mid-seventies became very popular in the eighties. Used the same cassette as the Betacam but recordings were incompatible with Betacam players. It never took off in Europe, but had a strong presence in the USA and Japan until relatively recently.

VHS: Released after the Betamax in 1976, it spread around the world, with more than 300 million players. Allowed recordings of up to 5 hours at normal speed and 8 hours at slow speed. On some machines, sound was recorded in hi-fi. Bandwidth was limited to 2.3 MHz. Horizontal definition was 240 lines. VHS-C is a variant packaged in a very smaller cassette. It allowed recording in camcorders and required an adapter for playing on a home player.

V 2000: Produced by Philips and Grundig from 1979 to 1988, it existed only in Europe and was intended exclusively for the recording of domestic television programmes.

Video 8 (or 8mm): Mainly a camcorder format. The cassette, barely larger than an audio cassette, contained a magnetic metal tape allowing recordings of up to three hours (in long-play mode). Sound was recorded in frequency modulated mono or in PCM stereo. Some VCRs managed up to 18 hours of recording on the same tape. The picture bandwidth of 3.2 MHz was barely higher than that of a VHS. Like the U-Matic, they allowed direct access to component video signals Y-C.

# Preparation of magnetic tapes

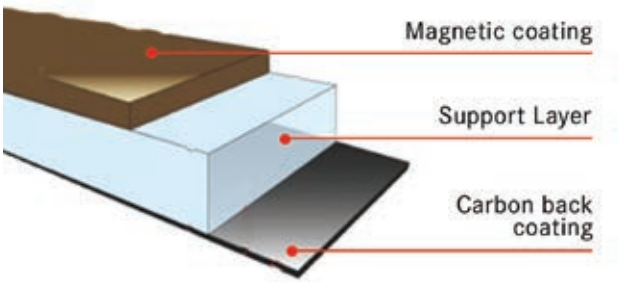
Preparation is a fundamental stage, during which a certain number of treatments are applied to the tape. The goal is to ensure that at the moment of transfer, the tape is in good shape to provide the best possible signal without any risk of damaging the play heads of the player. It is often the last time the tape will be played. Nothing must prevent the player from recovering all the recorded information

## Visual examination and repairs

A visual examination of the tape or cassette by an expert decides the initial treatment. Physical repairs, where required, are carried out first. After that, depending on the condition of the tape, it will be either tested in a player or sent for cleaning.

## Tapes made up of layers

The deterioration of magnetic tape over time is unavoidable. The rate of destruction varies according to the type of tape and the manner in which it is kept.




*Typical layers of magnetic tapes*

The treatment of magnetic tapes requires a good knowledge of their structure and of the physicochemical characteristics of the different surface coatings. Tapes were originally made from acetate before PVC, then later, polyester was introduced. These tapes are coated with a magnetic coating of between 3 and 4 microns in thickness, made up of a binder holding particles of iron, oxide or metal. The back face of the tape is covered with a carbon-based layer to assist the elimination of static charge and facilitate running of the tape through the playback or recording apparatus. Not all tapes have this back layer. It tends to be found more on professional tapes or high-end consumer products with a high recording density, such as Hi8 or DV. The latter usually have an additional layer to protect the very thin magnetic coating.

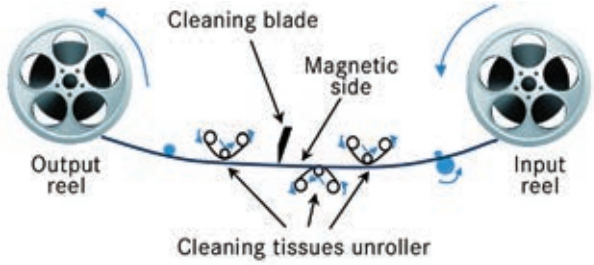
## Impact of dust and dirt

As technology improved, binders became more stable and the size of the magnetic particles diminished, allowing more information to be recorded. But the greater the density of information, the more sensitive the tape. Any particle of dust creates playback issues. The problem is exacerbated on more recent tapes because it impacts the playback of a larger part of information. The same applies for creases on the tape.

## Tapes cleaning

It's not only about dust. Tapes deteriorate and generate a deposit that often comes from the carbon back coating. This clogs up the rollers during playback, which must then be cleaned. To avoid that, tapes themselves must be cleaned before digitization. Cleaning equipment used for this task has become less and less available. So the new solution is often to design such equipment using an audio tape reader frame that's equipped with the convenient blades and tissues unrollers.

As their motors are very soft, such machines take care of tapes often better than the cleaning devices you can purchase. A tape can be cleaned several times through a cleaning machine if it is particularly dirty. But the process is a trade-off. Cleaning must be carried out without causing further deterioration. It requires constant attention of operators.




*Cleaning principle*

## Automatic correction

Many playback issues are automatically corrected at playback time. This is the case with the more recent digital machines when the tape surface issues are relatively minor. The VTRs rebuild the signal. There's no impact on pictures. Beyond a certain point, automatic correction of reading issues stops working and the effects is disastrous. VTRs can rebuild the picture but the original is lost. It's important to keep track of such issues when heritage digitization is concerned. The so called CRC should be logged as metadata to help curators when restoration is concerned.

On audio recordings, when it's impossible to read some samples, the effect may also be disastrous. If perfection is required, restoration is expensive and time consuming.

## The effects of time

As they age, magnetic tapes may deteriorate and become sticky. As running through the playback machine becomes more and more difficult, it starts to make screeching sounds.

*U-Matic tapes cleaning*

This is due to unstable binder (glue that holds the oxyde particles) formulation that were used by manufacturers in the past. This issue is known as «Sticky Shed Syndrome» (SSS). It is due to the ageing of tape components and varies from one tape to another, depending on its manufacturer and on its year of production.

## Overcoming the effects of time

It is possible to minimize this ageing issue by heating up the tapes for a fixed period.

This process is known as the baking process. It's a common practice to temporarily overcome the Sticky Shed Syndrome.

Tapes are hydrophylic. Baking allows removing unwanted moisture that was accumulated in the tape binder. This corrective measure is effective during a few hours, a few days or a few weeks. It allows the tape to be digitized. After that, the tape reabsorbs moisture and it's difficult to play again. The operation may be usually repeated a few times but it's recommended to digitize quickly the content to avoid further deteriorations. The process must be supervised by a specialist and heating conditions carefully controlled. Be careful with cassettes and avoid plastic reels. We have seen disasters.

Baking parameters vary from tape to tape. Each engineer has its own set-up. At Vectracom, we usually recommend a temperature that's slightly above 50° C ( 120°F) but this is really adjusted on a tape per tape basis. It can take from 6 hours to 2 days and the process may need to be repeated depending the physical condition of the tapes. Such parameters better preserve the tapes and avoid issues.

To facilitate tapes preservation and avoid moisture to be accumulated in the binder, it's recommended to store magnetic tapes in environments where humidity is low.

Indeed, baking makes the tape brittle, reduces its lifespan, affects magnetic fields and lower output signals. But it's usually not an issue.

## Vectracom services

- Preparation carried out on site, or in Vectracom workshop
- Preparation of any types of magnetic audio and video tape
- Analysis of archive status
- Detailed examination of all elements
- Repair of tapes and cassettes
- Cleaning with machines specific to any
- formats of tape (2'', 1'', 3/4'', 1/2'', 1/4'', etc.)
- Analysis of tape quality
- Baking with appropriate parameters
- Listing of content with TC location
- (TC In - TC Out)
- Repackaging
- Labelling according to heritage standards
- Constitution of tape sheets
- Collection and transformation of metadata
- Ongoing workflow management

*Tape baking*

# Digitization of video content

This is the process of transferring broadcast content from its initial medium (usually magnetic tape) into files. Sometimes, when the tape is digital, it is a straightforward transfer of information, but when the medium is analogue, audio and video signals need to be digitized.

## Video content recorded in composite

Some old formats (2 inch, 1 inch, U-Matic, VHS) record composite (NTSC, PAL, SECAM) signals. Indeed, playback equipment provide composite signals, which reflects what is recorded on tape. The signal, then, has to be decoded. At this point, the quality of the decoder and its filters is key. This is not the place to cut corners. The decoder provides component signals which have only to be digitized.

## Digitization of content in component signals

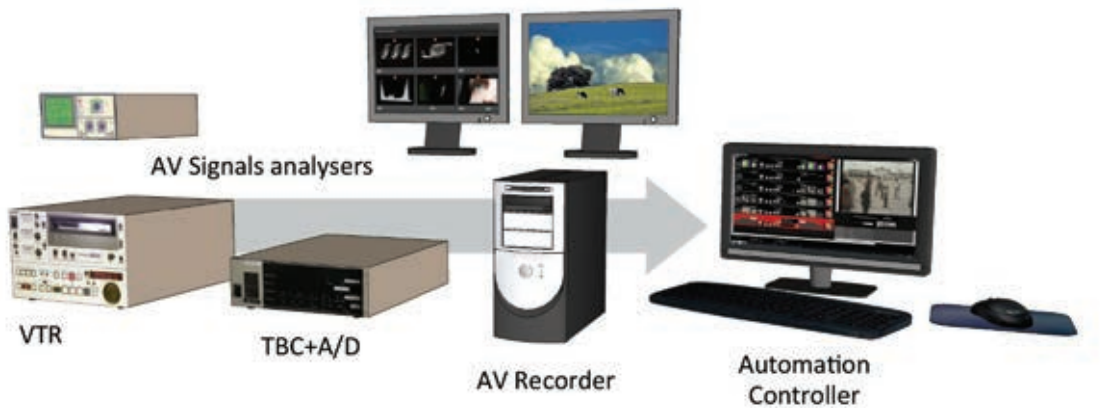
More recent formats, such as Betacam and MII, directly record component video signals. They can be digitized as they are using an encoder, which creates a digital signal in accordance with the CCIR 601 standard that has been used by all professional digital systems for over 20 years. In the created digital stream, encoded audio tracks are added.

## Recording format

Digital signals can be recorded as they are, without encoding or compression. This way quality is optimized but the files are space-consuming.

More often recordings are treated to reduce file size and make them conform to the established preservation format. This stage can be accomplished on the fly during digitization, by the processor in charge of the signal recording or it can be done later in a special render farm.

The result is the same in both cases. The choice is made according to the resources available for the task. When High Definition is concerned, MXF/OP1a/MJPEG 2000 and ProRes HQ are often created later as they require more computing power than recorders usually provide.




*Components of a standard video digitization channel*

| More difficult tapes | Less difficult tapes |
|---|---|
| 2inch, 1 inch B from Agfa, EIAJ, U-Matic, BVU, D1 | 1 inch B, (excepting Agfa), All betacam, D2, VHS |

*Some tapes are easier to manage*

## Use of time base correctors

A variety of elements may be used for completing the encoding operations in the CCIR 601 format. Their choice is not critical. What is critical is the choice of TBC.

A quality transfer cannot be obtained without a TBC, which allows any errors caused by the mechanical instability of playback and recording machines to be corrected.

Some playback machines offer simple TBC, and if you simply want to visualize content, that may suffice. But in the task of safeguarding audiovisual heritage for posterity, a more sophisticated external TBC is required in order to produce a stable and consistent signal.

## Wall of playback machines

For formats such as VHS, given that equipment is inexpensive, a bank of equipment consisting of several videocassette players can be used, supervised by a small number of technicians.

Naturally this type of system is also more automated as the operators have only to load the VCRs. Few checks are carried out during transfers.

*Wall with 32 VHS recorders in operation*

## Using cart machines

For some formats, such as Betacam or DVCAM/DVCPRO, cart machines are available and they can be used to digitize 24 hours a day with no special supervision required apart from that provided by a suitable automation.

Operators load and unload tapes. Transfers survey is mainly done by the automation system controlling the players, the cart machine, the transfer chains and the signals under digitization.

*Cart machines operations*

## Digitization with continuous monitoring

When tapes are old, sticky or fragile, they are difficult to digitize. In that case, operators supervise carefully the digitization process and stop it when they estimate that superior quality could be achieved. They then clean the tape, bake it, clean playback heads and tracking mechanisms, etc. After they restart the digitization process. Several passes may be necessary as many issues can arise that call for several often repeated operations. At the end of the transfer, the best fragmented recordings are selected by the operator and assembled automatically.

*Operations on a double 2inch ingest station*

## Vectracom services

- Mass transfers (low-cost) in highest quality
- In-house special hardware and software
- Use of appropriate systems for each job
- Qualified Technicians and trainers

Professional machines required for the transfer or digitization of audiovisual heritage are not standard encoders or video servers. The required systems are made of special equipment. It's a MUST to guarantee quality work while maintaining competitive pricing. Vectracom has developed its own hardware and software tools enabling all types of architectures to be produced, from the simplest chain to the most complex digitisation architecture including walls of playback equipment and cart machines of any capacity.

«EasyFlex» software
Designed for cart machines digitization


«EasyAlone» software»
Designed for walls of VTRs digitization


«EasyAlive» software
Designed for difficult tapes digitization

# Main media files formats

There are many ways for storing sound and visual information making up content.

An exhaustive study is almost impossible, so great is their number. New formats appear every year. Shown here are a number of formats that have been used and which continue to be used by many.

Technological progress allows more information to be stored in less space, and older technologies are left behind every time a new technology appears. This part of our document is intended to evolve with time. Please, check your version of this document, make sure you have the most recent information and update as required on Vectracom web site.

## Selecting video formats

File formats become more specialized as technologies improve. Some containers and some types of compression are better suited to transmission, some to production, and others to preservation. In the end, the administrator will choose one or several formats. Hence it has become clear that increasingly, archive data is preserved in at least three formats.

- A preservation format, usually of very high quality and very high resolution. It is very space-consuming and storages costs are high.
- An intermediate format, also called mezzanine format, which is much less spacious and allows for immediate editing but not necessarily the fabrication of a final element.
- A low resolution format for browsing purposes.

## Main video formats

DPX is an ANSI / SMPTE (268M-2003) standard. It is the exchange format commonly used by laboratories in exchanging fixed images as it is very flexible in the storing of colorimetric information. It also offers the addition of a large quantity of often obligatory metadata, such as image resolution, colorimetric space, name of original file, date and time of creation, project title, copyright information, etc.

It records images. Several files are necessary to record and exchange sequences of pictures. This standard is broadly used in cinema post-production. Pictures are often stored without encoding and without compression. This results in very large file sizes. DPX is not a container format. It does not include an audio track. Audio tracks are thus kept in separate files.


*Some of the formats used for storing audio and video*

MJPEG200 is an ISO/IEC standard which specifies the use of JPEG2000 for image sequences. It is an open source format based on wavelets compression. The JPEG2000 compression can be lossless or not, in SD, HD, 2K, etc. It is the recommended format for digital cinema (DCI) and is currently the only standardized profile. JPEG2000 is increasingly regarded as an option, and has been adopted for national archives (US/Canada). It is also pushed by the majors in the US (Fox, Warner bros). It is considered as a compression solution for high quality formats such as 4K and 8K.

MXF is a container or wrapper format. It supports various streams of essence including JPEG2000 and MPEG2. MXF is interesting as it has full timecode and metadata support and is supposed to be a stable standard for future professional video and audio applications.

ProRes is a proprietary format developed by Apple. There are a number profiles, with varying degrees of compression including lossless visual compression. All resolutions are supported, from very low to HD and 4K. Its main advantage is ease of creation and editing, using the brand's tools. This explains its wide use for storage and post-production.

H264 (MPEG4 part 10 or UIT-TH 264) is a standard developed jointly by UIT and ISO/CIS. It has a wide range of applications since its numerous profiles cover the needs of both the Internet and the cinema.

H265/HEVC (High Efficiency Video Coding) is new standard intended to replace H264. It was finalized in 2013, which explains the fact that it was still not in wide use at the time of writing. In comparison with H264, the aim is to obtain equivalent quality while reducing the data rate by half.

Its applications concern both the compression of very high definitions, such as 4K and 8K, as well as reducing the bit rate of SD broadcasts for television applications, VOD, as well as video on the go.

The DV, or Digital Video format, dates from 1996. Developed by a consortium of 50 companies, including Matsushita, Philips, Sony, Thomson, Hitachi, JVC, Mitsubishi, Sanyo, Sharp, Apple and IBM, it is supported by all editing systems. It's a historical format that has been available in different DV versions, miniDV, DVCAM (Sony), Digital8 as well as Panasonic's DVCPRO25 and DVCPRO50 . Recording digital elements in 4:2:0 at 625 lines and in 4:1:1 at 525 lines, it gives excellent quality rendering but is limited to certain post-production operations. Its main advantage lies in the fact that it is usable on all professional editing equipment.

MPEG2 offers a better rate of compression than DV. It is a (ISO / CIS 13818-1, 2 and 3) standard that is thus used for this aspect, particularly with different picture resolutions, in DVD and for broadcast.

## Selecting audio formats

There are also several audio formats, but given that less information is transmitted than is the case of video, the importance of compression is felt less strongly. Sound is thus more often recorded without compression, with good resolution and a relatively high sampling frequency.

In audio, only two formats are mentioned. One is for preservation, the other for browsing. The editing format is the one that's used for archiving.

WAV/PCM is the most common format for the purposes of preservation. Hence MP3 tends nowadays to be replaced by AAC.

## Main audio formats

WAV is a Microsoft and IBM standard used to store digital audio in various formats. It is now an old format allowing storage in numerous formats, such as MP3 and WMA, but in general, it is used to store sounds digitized in the PCM (pulse-code modulation) format.

PCM is used to digitally represent sampled analogue signals.

This sampling technology is widely used, notably in audio compact discs, DAT tapes, mini discs, DVD and Blu-ray, as well as for WAV files. In general, this is how sound content is preserved, with a sampling frequency of 44.1 kHz (used for CDs), or 48 kHz or even 96kHz (used in studios and for sound mixing).

### Vectracom services

- Consulting for selecting the most suitable preservation, mezzanine and review formats
- Transcoding from any format to any other
- Possibility of creating «mezzanine» files and proxy files from preservation files
- Support for all preservation file formats
- Creation of DCP packages for cinema projection
- Creation of VOD packages that meet worldwide platform specifications
- Conversion of standard NTSC <-> PAL
- Modification of aspect ratio to meet
- requirements (4/3 — 16/9, and others)

FFLAC (Free Lossless Audio Codec) is widely used because it is a free, open source codec that allows lossless compression of audio signals. In comparison with WAV, it allows file sizes to be reduced by half on average, which is not insignificant.

MP3 is the sound specification of the MPEG-1 and MPEG-2 standards. It is a compression algorithm able to drastically reduce the quantity of data necessary to restore audio. From the 2000s onwards, the majority of exchanges of musical files have been carried out using MP3, making the format ubiquitous.

WMA is a Microsoft audio compression format. Its use is widespread around the Internet, and is compatible with most portable audio playback equipment.

AAC (Advanced Audio Coding) is a standard conceived in 1997 to replace MP3. In terms of quality, at 128 kb/sec it is identical to MP3 at 256 kb/s. There are several AAC profiles to suit the particular needs of DTT and mobiles. It is compatible with digital rights management and is used or supported by the products and services of a variety of manufacturers such as Apple, SONY, Nokia and Nintendo.

# Media files quality control

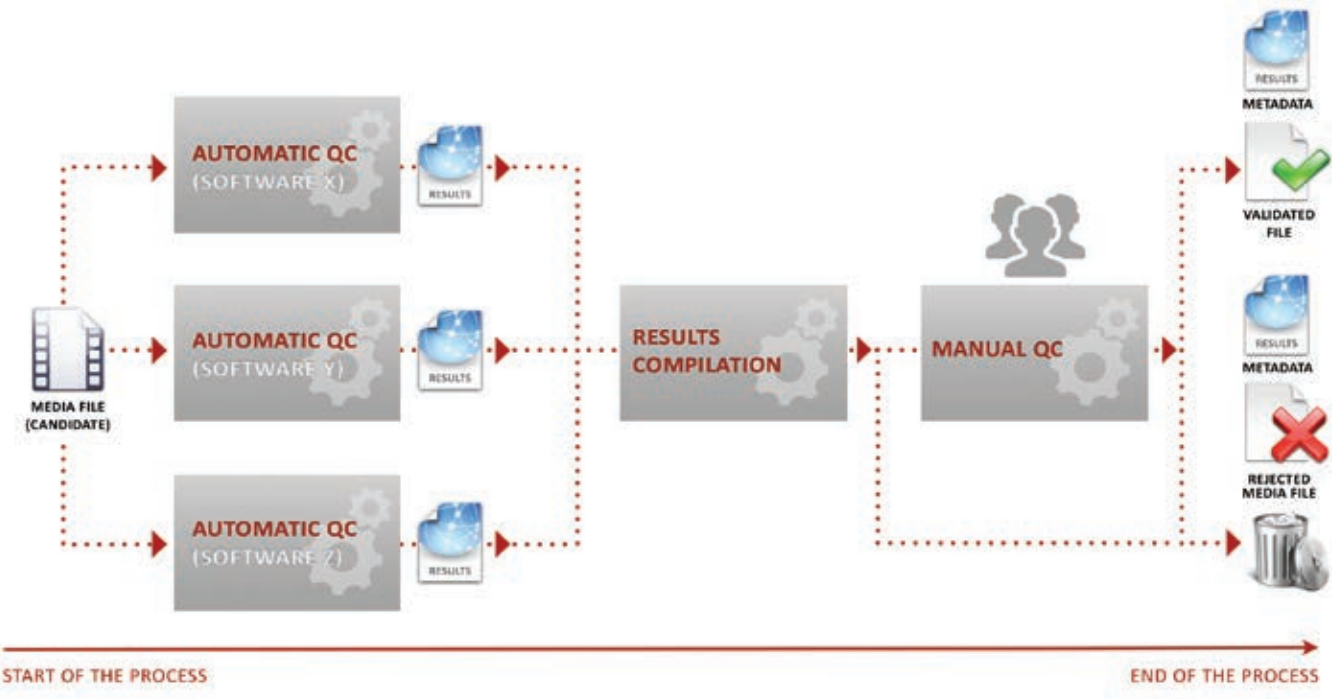
## Digital does not mean quality

It is a wrong to think that digital is synonymous with quality. If that were true, there would be no need for quality control. But digital does not mean quality, and control is essential in the digital environment. Given that we are only in the early stages of digital, we are likewise in the early stages of quality control in digital environment. A range of tests can be carried out on digital media that may cost more than the production of the digital file itself. It is therefore important to set the bar at the right level.

## Packaging and content

On the one hand the integrity of the audio and video streams must be compared to standards, while on the other, quality of content must be checked. The EBU has listed around 150 tests or checks applicable to audiovisual content recorded in files. For every project, a schedule must be prepared which defines the tests to be carried out. It is a matter of identifying the rules to be respected and the degree of acceptable error each time a measure is considered.

It is necessary, then, to turn to automatic QC systems. There are many on the market, each with different characteristics. In the end, for good checks, quality control must be shared between man and machine. Machines are used for what they do well, while man is used because he is irreplaceable. In the end, machine helps man but man makes the decisions.Testing of files must be carried out as soon as files exist. At that time, the expense of non-quality is at its lowest. The later you test, the more work will have to be redone. If you are using a bad file in a new production, it is better to realize that the file is of poor quality before starting.




*Quality control process in Vectracom operations*

### Automatic QC and manual QC

100% of files created should be analysed. But manual tests are a long and painstaking operation. Moreover, the reliability of modern systems and the quality required for archives often do not demand 100% of the content to be viewed or listened to. There are also defects that an operator would not be able to see, notably in terms of file structure.

When a file is readable, it does not make it correct and compatible with all playback equipment.

## Automatic checks

Automatic tests systems are preferred for validating the compliance of audio and video streams settings, and of metadata in the specified file format (metadata, sampling, length, rate, size, ratio, encoding). Overall, at this stage, it's a matter of verifying that the file is readable. These systems can also measure the component parts of audiovisual signals (levels, phase, range, etc) and give information about other image quality defects, such as pixellation or drop outs. All this information is of interest to the operator, and having access to it facilitates his task.

## Human validation

Operators carry out the final validation. In order to do that, they must check the presence and quality of audio and video signals at the beginning of programme, at one or several intermediate points, and at the end of file.

- He checks the beginning of programme to ensure that it's not cut, and that a lead-in is in place if required;
- Viewing the middle of the programme allows the quality of audio and video signals to be checked (levels not too saturated or too low, no clogging of playback heads during transfer)
- Checking the end of the programme ensures that it has not been cut, and the lead-out is in place if required.
- Results provided by automatic testing systems are very useful in helping operators to make decisions more quickly and in full knowledge of the facts.
- When the results of automatic testing indicate parts of the content in need of attention, the operators validate or invalidate the alerts after checking..

### Vectracom services

Vectracom analyses and validates :

- All files produced by its transfer channels
- All files entering its treatment channels

In-house QC software designed for specific needs

- Validation of large quantities of files
- Use of results from tests performed by the most common systems on the market (Baton, Cerify, Aurora)
- Shows results of automatic tests to operators

Quality control information is recorded by Vectracom workflow manager and compiled to be forwarded to media asset management


*Quality control workstation*

## QC results are metadata

The expert then, validates the files and adds supplementary information as useful metadata to be saved.

A note is made of any observed defects and a solution is proposed : correct, redo, analyse, etc .

## Better QC with 2 operators

The operator who validates the files should not be the operator who encoded it.

This way a true double-check is carried out, which avoids the risk of accumulated errors in evaluation.

# Storage of digitized heritage

Playback of audiovisual content requires a specific tool. Historic tools, such as projectors and VCRs are rapidly disappearing along with the media they play. One might think that these problems belong to the past, and that we have put them behind us. Far from it. It is not possible to store an audiovisual medium and then forget about it. Preservation of audiovisual content calls for an active management strategy of storages and players. The challenge consists in always having a copy of content that's legible, usable and can be copied. Digital allows recorded information to be copied an infinite number of times without any loss or quality or deterioration. Hence by implementing a certain number of techniques, it may be safely preserved for eternity.

These techniques incur an expense that should not be underestimated. The risks engendered by cutting costs need to be carefully assessed.

## Magnetic discs

*Desktop Hard Drives*

It's the easiest way to preserve small volumes. But media are not safe in such hard disk drives.

Several copies need to be kept in several different places.

To improve security, discs must be organized in clusters (RAID).

## Magnetic cartridges

Magnetic tape offers the most efficient method of lowcost storage and transport of large quantities of digital information. The LTO (Linear Tape Open) cartridge is the most widely used. Its capacity grows as technology progresses.

In 2013, LTO6 could store the equivalent of 200 one-hour DVCAM tapes. By 2017, the storage capacity of the projected LTO8 cartridge will be the equivalent of 1000 DVCAM tapes.

*LTO cartridge*

## Computer systems

When a large quantity of data is to be saved, computer systems are required to preserve and distribute it. Of course, the costs incurred are not limited to hardware, as systems need to be maintained and managed. Such is the price of preserving and maximizing the potential of audiovisual heritage

*Archive Storage by FGC in Saudi Arabia*

## Clouds

These are IT systems located in secure centres, managed by administrators offering data storage services. Rather than buying and maintaining a system, it is possible to use it and pay only a regular fee. Such services are very convenient but usually they manage only data and do not take into consideration specific aspects of the media they host.

### Vectracom services

- Hosting of audiovisual heritage in preservation formats on servers and LTO robotic systems
- Secure backup by regular testing of media playback
- Formats migrations
- Low-cost preservation of heritage on LTO tape
- Deliveries of media through web transfer, on discs and on LTOs, according to requirements

# Drafting preservation projects

## Knowing one's audiovisual heritage

The first requirement is to draw up an inventory as detailed as possible of what you have. All the content, and anything to do with it, must be gathered together. Anything may be useful. Devote as much time as possible to this task. Every minute spent here will save you at least an hour in subsequent stages of the operation.

## Specify requirements

Once you know exactly what you have, it is easier to imagine potential uses and estimate or define the value of your heritage. Quite often, content is required in a digital form and digitization is a necessity.

## Research budget

At this stage, researching the digitization budget becomes a priority. You will need to identify organizations able to finance the project and get them interested by showing them its value. You will need patience and help.

Do not embark upon this adventure alone or your chances of success will be slim. Check out what other people have done and how they found financing. There is a lot to learn from others.

## Estimate resources, costs and delays

We have come to realize that owners of audiovisual content overestimate the expense of digitizing their media. It is best to ask for the help of a specialist to estimate the resources required and have evaluations validated by a second opinion. Digitization of heritage demands the application of little-known, specialized techniques. Reading this document will help you but you should realize that expert assessment is necessary to achieve accurate costing.

*Inventory in progress for a 2 inch tapes archive*


*Preservation projects require a lot of skills*

Digitization of audiovisual heritage can be considered as a job for artisans. At the same time, repetitive tasks are required. And in that sense it does have an industrial aspect.

## Do it onseself or outsource

It is unlikely that you have within your operation all the skills necessary to complete your project. Anyway the skilled people you do have are supposed to perform other tasks. Thus you will look outside and weigh up the benefits of outsourcing. Sometimes, colleagues will tell you that they can do job easily and quickly. Hear them out and make comparisons. Compare everything. Expertise in the preservation of audiovisual heritage cannot be improvised. To extract the best signals from old media, special techniques are required and the learning curve is a long one. At Vectracom, we have often been asked to step in to redo what had already been done by inexperienced personnel who had promised to work quickly and efficiently but ended up delivering a botched job that exceeded the initial budget.

A carefully chosen specialist company will supply guarantees with regard to the budget, deadlines and quality you require.

## On-site work

It is simpler for your service provider to work on his own premises where all the required equipment is based. But for you, transporting your heritage might be difficult or even unthinkable. A compromise will then have to be found, and your service provider asked to intervene in situ, either on your premises or somewhere nearby.

# Managing preservation projects

When budget is allocated, the second critical phase of the project needs to start. It's time to launch the digitization phase. At that point, your main obsession should be to preserve your heritage with the best possible quality. Respect of budget and planning are also obviously expected. To guarantee all these critical requirements, you'll need to contract with a service provider that you can trust. Be careful. Believe in people rather than companies. Avoid newcomers, ask about references and verify.


## Defining procedures to be undertaken

Defining processes is the first concrete step in the process of going tapeless. Seeing your service provider carrying out these tasks will make you appreciate his value to your project.

Everything needs to be defined: processes, procedures, tasks, workstations, skill sets of operators, recruitment, training and maintenance planning, production and testing schedules, delivery, etc.

## Recruiting, training and managing teams

A large number of tasks has to be carried out, and every task is important. The recruitment of skilled personnel is an important step, but staff may need training, and this is, of course, a critical operation. Experience means recruiting the right people. You do not always need to recruit skilled technicians. More often you need staff who are careful and attentive.

After recruitment, training is necessary. It isn't a case of dispensing technical knowledge as would a school, rather how to handle audiovisual heritage. Every new employee is trained to operate on archive data workflow according to his or her personal aptitudes.

After that, managing the personnel is another task which should generally be left to the service provider, in order to avoid the worries that the appointment of temporary employees in your organization might bring.

## Designing a production system

Real systems for dematerializing audiovisual heritage are special set-up made up from equipment not easily available on the business to business market.

The playback equipment has not existed for a long time. The same is true for the preparatory machines. As for digitization chains, those found on the market are only appropriate for the digitization of new programs. They are unsuitable for the treatment of old media.

Of course you will have chosen your partner because he has all the necessary equipment, and you are quite right, because without the right equipment, the required work can only be partially accomplished, with a reduced quality output.

Availability of the right tools is a minimal condition for ensuring secure digitization projects.

## Managing production

It may seem simple but here again, real skill sets are required to manage production, oversee operators and guarantee, within an agreed budget, the quality of the final files. After training, staff knows how to operate equipment, but they lack experience. In the best-case scenario, they ask ques-

*System verification before shipment*

tions constantly. In this way their expert advisers are on hand throughout the project to help them and guarantee quality and productivity.

Playback equipment is a sensitive issue for any preservation project. Mostly these are old machines requiring proper maintenance. Technicians trained in maintaining and repairing these machines are required, and are thin on the ground. When selecting your providing, be sure there's enough security at that point.

To successfully complete all these tasks with a minimum of risk, a team of specialists to manage production and oversee operations is needed. Opt for the service provider who appears to have the greatest experience. He will be your best partner.

## Trust but check all

When production is underway, you will have to monitor the work to ensure that the promises made to you are kept. Appoint a project leader and call regular progress meetings. Insist on being given regular updates. Make your presence felt with your service provider. Make sure a suitable tool is in place for managing and assessing the quality of the processes underway. This will help your service provider, and you will be helping yourself. To reach the ends, one must have the means.

Each media delivered by your service provider will be controlled. And it's better twice. Then, you should have your own quality check. It's the last time you have a chance to verify that you have the delivery you expect and you pay

*Control desk of running processes*

## Vectracom services

**ISO 9001 certification**

- 20 years of experience
- A range of experts for all types of media: discs, magnetic tapes and film
- Advices with binding estimates
- Cataloguing of media, transfers and indexing of content on archive sites
- Use of mobile, on-site systems
- Mobile teams made up of technicians, operators and operations managers
- Recruitment of local manpower for digitization and indexing operations
- Supervision of operations by experts who guarantee productivity and quality
- Return of initial physical media cleaned and repackaged
- Quality control and validation of all media files
- Delivery of files directly within the digital storage
- Formatting of metadata for MAM
- Regular progress reports during operations


# Valorization of Audiovisual Heritage

# Valorization of audiovisual heritage

## Making more dynamic use of archives

Valorization of audiovisual heritage means making more dynamic use of content.

Thanks to digitization, new computers and telecommunications technology, digital content can be distributed to a very wide public.

The technology needs to be used to develop access to content.

You should think about the ways you can promote your content and implement the one you believe is more efficient. It's a starting point. At the end, you should use all the possible ways to make your content available and seen.

## Create lucrative businesses

Content can be used in many ways. It has inherent value that can generate revenue or save cost. The goal is to materialize this value to create profitable business.

The most common uses are:

- Consultation by scientists, researchers, students, journalists, individuals
- Illustration for news purposes, particularly on television and in printed press
- Entertainment, such as cinema or video on demand
- Production of archives-based films
- Multimedia projects

## Each case is different

Every use has its own needs, which are defined in terms

of technical quality and documentary indexing. Data to be used for entertainment purposes is treated differently to that intended to illustrate televised news reports.

At the preservation level, when the project for digitization and archiving is designed, you usually know how your archive will be used. It's the right moment to think about the metadata that should detail every content. It's also the moment to define requirements for your MAM and imagine how the metadata will be collected or created.

### Ensure security and guarantee rights

Any use relies on access to the media. While maximizing potential involves facilitating access, there is a duty to ensure appropriate security of access, for users, owners and rights holders.

This is usually where things become complicated, because while technological advances have solved the problems of how to disseminate audiovisual content, legislators certainly have not simplified rights management. Depending on the country and type of content, things change enormously. You need to bear in mind that having a digital copy of audiovisual content does not give you the right to use it, much less to sell it. Rights can be acquired, and current legislation makes this a necessary step. It is the duty of every professional involved in the audiovisual industry to respect copyright and ensure copyright is respected in the fight against audiovisual piracy.

# Using MAM

## Indispensable

While not all collections require the same treatment, all of them deserve to be managed. Without management, exploitation is impossible.

A collection of audiovisual data consists of content called assets. Managing such collections requires a computer solution known as MAM (Media Asset Management). It is extremely difficult to maximize the potential of archive data and extract commercial value from it without using MAM.


## Choice of MAM

Choosing a MAM is difficult, given the wide and varied range of products on offer. To make the right choice, goals, objectives and requirements must be carefully assessed. It is easy to miscalculate at the outset what will be needed.

People often turn to professional systems with high global costs. It is therefore appropriate to show restraint and be inventive. The budget usually depends on the value of content, which itself depends on how interesting and rare it is.

### Basics of MAM

- Acquisition
- Indexing
- Consultation
- Visualization
- Broadcast

### Basic MAM features

- Ingestion
- Indexing
- Search
- Browsing
- Curation
- Dissemination

Your MAM will probably need additional features over and above the traditional basics.

It'll need to connect with your other systems to supports the processes that are required by the new dematerialized digital economy. Efficient management of workflows is key in delivery of content in an expanding range of formats.

### Vectracom services

- Storage platform with integrated MAM
- Secure remote access with no equipment to buy or install
- OPEX exclusively for the owner
- Delivery of any kind of package to any type of organization
- Secure storage for the price of a rental
- Advice on the choice of MAM should you opt
- for a service outside Vectracom offer

## MAM as a service

You must consider not only the cost of software but also that of equipment and maintenance. And of course, you need staff capable of supporting the system you opt for. All this is very expensive. But there is an alternative.

Rather than buying your MAM, you can enjoy this type of product as a service. Outsourcing MAM goes hand in hand with outsourcing the preservation of your audiovisual archives. Unless you work in the audiovisual industry and can manage your archive by yourself, it would be preferable to outsource. And, even if your business is about content production or distribution, preservation requires additional investments you may want to avoid.

## CAPEX or OPEX

Technology gives you a choice. You can invest (CAPEX) or outsource (OPEX) the technical management of your

audiovisual heritage and have only to pay a regular fee.

In the modern economy, companies focus on whatever produces value. Unless the preservation of archive data is your key business, you are better off outsourcing.

Only the holding of secret and confidential archive data warrants internal management.

# Restoration of content

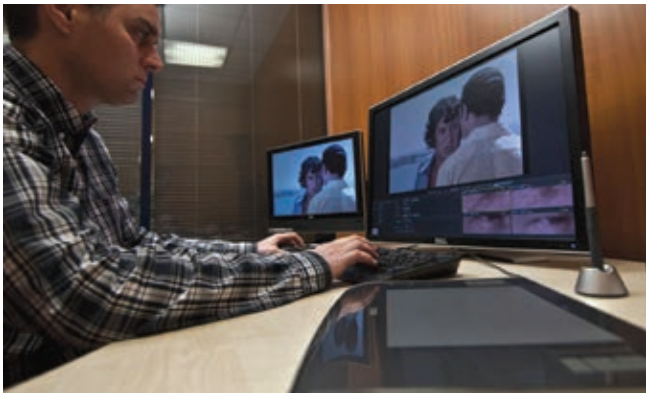
## Color grading

The colours of scanned content are usually not the original colours as film stock ages. If an old film copy has to be used for broadcast in a modern environment, its colorimetry must be adjusted. This operation can either be carried out at the moment of transfer or at a later date. Technology is evolving and post treatment is more and more favoured as the required equipment is increasingly rapid and attractively priced. The fact remains that the scanner or telecine must be correctly set for transfer to maximize recovery of dynamics in both image and sound.

*Color grading on Nucoda workstation*

## Restoration of moving images

Images deteriorate with time. The apparent artefacts vary according to the original medium. In the case of film, the problem is vertical scratches, various traces of glue, dust and cracks. In the case of magnetic recordings, the issue is horizontal dropouts, problems linked to brightness levels and colorimetry. Restoring an image involves removing the defects accumulated over time. Once the content is available in digital form, restoration is carried out with the aid of digital tools. Take care, though to keep a copy of the digital content in its original state, prior to any restoration work. Restoration changes the original copy and in a sense degrades it. It would be a shame to lose an original version that could be better restored in near future.



*Restoration on Revival workstation*

Restoration is always carried out with a definite purpose, most often to create a master which will be used for a TV broadcast, the creation of a DVD or Blu-Ray, VOD, etc. Restoration is not usually carried out for the purposes of archive work. Files are archived in their original state.

Restoration of image is computationally demanding and takes time. To speed the process up and obtain remarkable results at a very attractive cost, restoration can also be carried out in real time with special electronic processors in the case of SD and HD.

## Restoration of sound

Audio restoration is a delicate process. While equipment is available that allows work to be carried out quickly, and will legitimately improve old recordings, it is difficult to quantify the work required to clean up sound.

The software traditionally used eliminates pops, clicks, crackling, buzzing and hiss.

*Sound restoration console*

### Vectracom services

- Colour correction during transfers with Pandora Pogle
- Colour correction after transfers on
- DigitalVision “Nucoda” or Black Magic Design
- “Resolve” equipment
- Restoration of images using Nucoda or Da-Vinci “Revival”
- Real time restoration with Snell “ArchAngel” HD
- Sound restoration using Protools systems with Sonnox Restore plug-in

# Accessibility of content

It's about anything that improves access to content.

First, professional researchers and the general public need to be able to find content easily among the archive data they have access to. Furthermore people with diminished faculties of perception (the hard of hearing and visually impaired) need to be able to make full use of media.

Metadata is the data that accompanies and describes media. It may be a script, the audio for a video recording, photographs and various texts such as scripts, a summary, or a transcription of an interview. All this metadata helps bring value to media. It links contents together and makes them more easily found by facilitating navigation. Metadata is information that must be collected throughout the life of media content and must be organized and carefully preserved. This is the job of the archivist. Some metadata is recommended, some is obligatory. This applies in certain countries with regard to subtitles and audio descriptions.

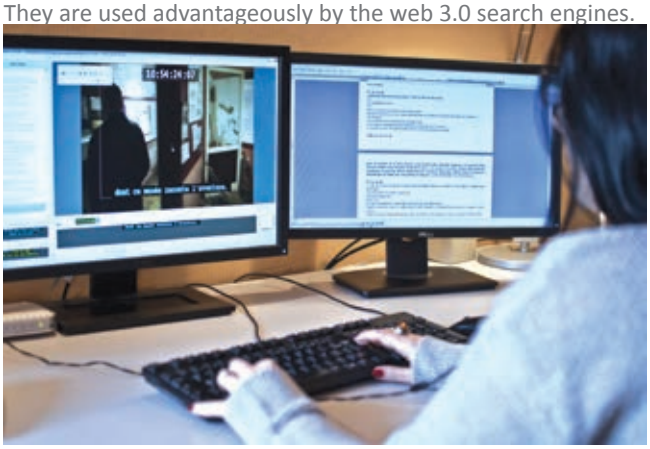
## Subtitles

Subtitling (closed captioning) allows the deaf and hard of hearing to follow and understand audiovisual broadcasts, notably films. Originally used in the cinema, the technology was then adopted by television and is now used for all types of programming, such as series, documentaries, and news. It now applies to all broadcast media, such as Internet and DVD.

It can be a simple transcription of dialogue, with some adaptation to make it more legible, or a translation. Subtitles are often produced from recorded programs but live subtitling is becoming more and more prevalent, forced along by the need for information to be transmitted correctly.

Subtitles are perfect for better indexing.

They are used advantageously by the web 3.0 search engines.



*Operations on a closed captioning workstation*

## Audio description

This is a technology that makes video content available to the blind and visually impaired thanks to a voice-over describing the visual elements of content. The descriptive voice, placed between dialogue or sound elements, does not harm the original work. It is usually broadcast on specific audio channels and used on headphones so as not to bother other viewers.

## Indexing

All metadata should be first collected or created. The value of audiovisual heritage is enhanced when its component parts are accurately described and listed. Documentary indexing consists in characterizing content by describing both technical and editorial points of view.

*Auditorium in use for audiodescription*

For the technical side, original media, end media and transfer information are summarized. For the editorial, descriptions and summaries are produced, either for the overall film or scene by scene. Increasing numbers of tools are available to speed up and improve the indexing of media (OCR, text recognition, shape recognition, voice recognition) but this remains a job for experts, using specialist techniques.

### Vectracom services

- Subtitling, transcription, translation, services, and production of subtitles and standardized subtitle media
- Audio description services, from narration through to delivery of media
- Cataloguing of media
- Indexing of content, overall and scene by scene
- Production of summaries
- Use of advanced systems to help generate metadata
- Optical character recognition
- Optical shape and logo recognition
- Voice recognition

# Use of heritage content

Content can be used either in its original form, usually after some cleaning up and reformatting, or in new content productions.

## TV broadcasts

*Legacy content is used for entertaiment*

For TV purposes, material must comply with the requirements of the broadcaster. On one hand, good quality sound and vision is required, on the other hand, the broadcaster needs a formatted version of the programme in the right container.

Broadcasting an old film with a scratched and blotchy picture is unthinkable nowadays. Every broadcaster has their own criteria and they will refuse any programme they regard as unsuitable either for editorial reasons, or because it fails to meet technical specifications or because the quality of picture and sound do not comply with required or wished-for standards.

*Content is used anywhere and anytime*

## VOD

With VOD, entertainment programmes are offered for viewing on demand, in general on home television sets. This is a booming market because media can now be viewed on portable equipment such as tablets or smartphones, as well as on very high definition TV sets (4K).

The term «cinema on demand» is now often used as the pictures offered have resolutions that are equal - if not to superior - to those used in cinemas. Different viewing terminals require different formats. Indeed, increasingly large numbers of AV files are being hosted on VOD platforms.

They are also becoming more and more complex, being veritable packages including the programme together with trailers, multilingual versions, subtitles, publicity posters, digital rights, and other information relevant to the transmission. With every platform having its own formats and quality requirements, the manufacture of packages has become a business in itself.

## Internet sites of companies, associations and institutions

All businesses tend to have audiovisual content on their internet site to improve communications and to better convey their message to prospective buyers, customers and the general public. Although not really archives as such, that's what these images are rapidly becoming, and they need to be managed.

Likewise, organizations such as territorial institutions and associations have an audiovisual heritage they would like their fellow countrymen, followers or even the general public to be able benefit from.Their media, then, must be organized into collections and formatted with all the relevant information so that they can be found, viewed and their potential maximized.

Technological evolution has led to more quality and greater reactivity. But the media must be updated regularly so that it appears in its best form. It's the price to pay in order to remain attractive and generate interest, website hits, followers and clients.

*Professionnal use of companies archives*

*Apollo missions documentary*

## Use of archives in televised news

Archives are also increasingly used in the televised news. They allow journalists words to be documented, and often act as justification in political explanations. It is estimated that 30% of images come from archives, but in general, the amount of truly old footage is much less. Nevertheless, no valuable newscast can exist without archives. As a consequence, the sale of archive material to broadcasters editorial staff is becoming a real lucrative activity, but the images need to be online so that they can be easily found and purchased by journalists. Nowadays, you need to get closer to large archive sites. In the near future, Semantic Web 3.0 will allow internet users to find archive images much more easily, whatever their location is, providing of course that they are online and properly documented. Technology, then, is going to offer new opportunities for maximizing the potential of audiovisual archives.

## Archive-based films

In the case of both documentaries and entertainment films, archive footage required by producers is reworked to ensure it meets the quality of new productions. The choice of footage is thoroughly researched beforehand. Images that are not available online, at least in low resolution, have less chance of being exploited.

### Vectracom services

- Creation of media versions with guaranteed approval from broadcasters
- Creation of packages that meet standards for all multimedia platforms (notably VOD)
- Online availability of audiovisual heritage with
- access restricted to classified rights holders
- Collection, storage and management of media
- Creation and migration of media files made necessary by
    - Technological evolution
    - New uses
- Automatic transmission of content to proper communication channels

## Online media availability

Of course, material must be made available online for its potential to be maximized. By making content accessible, you can materialize services for use by professionals or the general public. This is how museums stimulate interest and attract visitors to exhibitions. Similarly, a possessor of archive data will offer a glimpse of what is available in order to create a need and ultimately sell complete versions in formats that can be used in cinema or television. Heritage elements of enterprises are also put online so they can be consulted and reused by all members of a group. Whatever the case is, access to the media needs to be made secure. It would be irresponsible to allow free access to confidential or classified documents. But their online availability remains perfectly feasible if managed well, with the appropriate protection mechanisms in place. Legislation changes rapidly. Modern methods allow access for browsing to a large audience and restrict re-use for proper rights holders. The concept is progressing, and in future it should be easier to disseminate audiovisual archive material.

# Services platform for audiovisual content

# Services platform for audiovisual content

Strange how some people make life difficult for themselves, only to obtain poor results.

- By signing a preservation contract with Vectracom, you simplify life. You delegate to experts tasks that are outside your habitual line of activity to focus on the tasks that generate revenue.
- You do not have to invest. You know your annual budget in advance, and you are sure that it is consistent and nothing is going to change it.
- Your audiovisual heritage is guaranteed.
- It is accessible, and you can opt for more services when you need them, even for a short period of time.
- With Vectracom preservation platform, everything is straightforward.

**Master**

- No compression
- Lossless compresssion
- Visually lossless compression

**Mezzanine**

- Low compression
- Low loss for distribution

**Browsing**

- High compression
- Low resolution

*Several versions are usually managed*

## Creating an archive could not be simpler

- Your current collections are migrated by Vectracom's teams on your new platform located at Vectracom, whatever their original support is.
- Master copies are backed up on LTO tapes and one copie is returned to you for security and freedom.
- A low resolution version is immediately put online for immediate browsing.
- Mezzanine versions are created and put online according to your needs.

## Managing the deposit of new media

- The new elements are collected, qualified and stored by Vectracom.
- You are informed about every new deposit.
- Your media are verified as they arrive, so you know they are of good quality, useable by all the main software on the market.
- In the event of any defect, we organise updating, with the depositor if necessary.
- Your content is categorized and indexed according to your specifications.
- You can easily modify indexing from your office.
- We set user rights according to rules.
- You can change them as required.

*A secure storage and computing system*

## Improving accessibility with metadata

- Additional metadata can be automatically generated using «Speech to text» technology.
- This is available in many languages.
- Such metadata is useful to quicker find useful content.

*Management of media and medata generation*

## Users rights management

- Administrators have all rights from rights assignment to media deletion.
- Each user may have different rights.
- Your archive is splitted in collections.
- User rights may be different for each collection.

## Managing archive data is simple for you

- Vectracom takes every precaution to maintain the existence and usability of your archive.
- Media are regularly monitored, and their readability checked.
- You can recover your whole archive at any time with no expense.

*Work anytime anywhere*

## Using archive date is simple for you

- Rights holders can do searches and ask for copies of any content that shows up.
- Nobody needs special OS, software, or browser.
- You are kept informed of any move or by statistics.
- When requesters don't have the requested rights, an approval is requested. You receive a request and you decide.
- Media is delivered to wherever you want it, when you want it, in the requested format.
- Deliveries are by download, FTP transfers, Smartjog transfer, data cartridge, hard drive, tape, DVD, etc.
- If work is required on your media, you have access to
- Vectracom's technical facilities to transform your media as you like and create new content.

## Working in collaborative environment

- In your production process, you can manage approval by third parties. They receive an email for direct log on a web page from where they can browse, check, approve and comment.
- You are immediately informed of their decisions.

## Indexing content

- You can browse and index your media from wherever you are.
- A thesaurus is available. You build it and improve it's the repository of your business.
- We provide also automatic addition of metadata and manual indexing on request.

## Help all along the way

- Vectracom teams help you specify your needs.
- You will receive suitable training.
- Your content is migrated safely.
- When you have any question, we'll happy to help.
- If you have any new request from your customers, we can help you finding a solution. Usually it's already available.
- When you need extra services for a short period of time of more, we'll be happy to provide them.
- Vectracom is a service company and we are always happy to respond to new demands.

*Online assistance*

### Vectracom services

- Yearly preservation contract (OPEX only)
- Your master media files are secured on several media (servers and cartridges)
- Browsing versions are on line
- Mezzanine versions are available
- All standard audio and video formats are supported
- No special software is required
- Just a login and a password are required.
- Additional services are proposed to add metadata or improve indexing
- Vocabulary controlled with thesaurus
- Speech to text is proposed as an option
- Manual indexing is proposed as an option
- Secure upload of masters and download of all versions
- Detailed users rights management
- No cost at the end of the contract

# Vectracom's references

## Preservation





































## Series Subtitling, VOD, DVD, Blu-ray, audiodescription, live subtitling, indexing


















Vectracom is member of FIAT - IFTA http://fiatifta.org

https://www.facebook.com/vectracomgroup

# Notes

Vectracom
VIDEO SOLUTIONS

2, rue de la Justice

93217 La Plaine St Denis cedex

Tel: +33 1 55 93 42 42 - Fax: +33 1 55 93 42 43

www.vectracom.fr

SAS with 392 000 euros € capital - RCS Bobigny B 380 073 353
Siret 380 073 353 00035
VAT FR 09 380 073 353

ISO 9001:2008 CERTIFICATION

îledeFrance

pmup