



VIAA – Digitisation Wave 7: DV cassettes
Update on the project – June 2018

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I. Preparing the project

A successful carrier type for video recordings, DV cassettes (DV, DVCAM, DVCPRO) became very common during the nineties and was being used in a broad range of contexts from daily life to professional media. However, DV cassettes are suffering from decay and they are also facing an ever-growing player obsolescence problem: the production of the playback devices already stopped and spare parts are slowly becoming rare.



Fig. 1: the logo commonly used on DV cassettes

For these reasons, VIAA started the preparation for the transfer of these carriers. DV cassettes will be the subject of Digitisation Wave 7, to be carried out in 2019. The preparing activities are in the hands of Gaël Fernandez, an intern at VIAA's Team Digitisation coming from the "Gestion de Patrimoines Audiovisuels et Numériques" master program at INA, the French National Audiovisual Institute.

Since every digitisation plan starts with collecting thorough knowledge about the carriers to be digitised, VIAA always starts off with setting up a data model for the registration of the carriers. In order to define this for the DV cassettes, Gaël first studied their historical and technical aspects, through documents such as the DV Blue Book and publications by the Library of Congress' Audiovisual Working Group. He also visited various content partners of VIAA to see their DV collections and check the preservation conditions.

These visits already lead to a few first conclusions:

- There is a strong need to transfer these carriers before they start decaying and playback becomes impossible.
- DV is actually a generic term for a range of carriers that vary in tape composition and size for example. The format was produced by a lot of manufacturers such as Panasonic, Sony, Maxell or TDK. The large number of sizes and subformats may create confusion and cause identification mistakes.



- The carriers are scattered across many different content partners. One can find DV cassettes among Flemish cultural institutions and performing arts organizations as well as regional broadcasters. However, the number and the nature of these carriers are vague and need to be clarified by a thorough double-check.

The purpose of this report is to provide an update on the preparations of the project, and to help the content partners with an overview and some practical advice to recognize each DV type properly. This will also help them manage their own collection of DV cassettes better.



II. What are DV cassettes?

The history of DV based video cassettes started in 1992 with the so-called ‘HD Digital VCR Consortium’ in which tape producers Matsushita-Panasonic, Sony, JVC, Philips, Sanyo, Hitachi, Sharp, Thompson, Mitsubishi and Toshiba were represented. The purpose was to set up a non-proprietary encoding format for a new generation of video tape recorders and to replace Hi8 and VHS videocassette formats.

Although DV soon became a common digital encoding format, manufacturers created their own digital videocassettes: Sony introduced the first DV format-based videocassette commonly called “DV” or “DVC” in 1995. A few months later, Panasonic created its DVCPRO. Sony answered by presenting the DVCAM. During the nineties many other companies such as Apple and IBM joined this consortium increasing the number from ten to sixty members. Meanwhile in 1998 the International Electrotechnical Commission (IEC) standardized DV as IEC 61834. The same year the Society of Motion Picture and Television Engineers (SMPTE) standardized it as SMPTE 306M and SMPTE 314M as a standard for video tape recorders.

DV was issued to be the first relatively inexpensive and easy-to-use format based on roughly the same characteristics as the Digital Betacam, offering digital quality components, robust and small physical carriers for camera capturing, editing and even for archiving, although we can question that last claim very much now. Originally made for domestic use, in combination with the then ever more popular camcorders, it has been widely accepted by consumers but also by semi-professionals (industrial, educational, associations) and even professionals (broadcasters, video producers).

2.1 General digital features of DV cassettes

The DV codec, one of the earlier compression algorithms for video, is based on a lossy mode. This means on the one hand a higher efficiency in terms of storage because redundant information is discarded, but also that the optimal image quality cannot be reached again when decompressing the information. The compression of DV is a spatial compression: an intra-frame model based on the suppression of the redundant information from one frame to another (irrelevant details, immobile things, etc.). The aspect ratio of the frame is 4:3 or 16:9 for 720x480 (as NTSC) and 720x576 (as PAL) in interlaced or 720p in progressive. Chroma is commonly subsampled on 8 bits in 4:1:1 or 4:2:0 except for the DVCPRO HD format which features an 8 bits 4:2:2 set up for production.

Furthermore, sound is not compressed and offers optimal quality while encoded as a raw pulse code modulation (PCM) file at 48kHz and 16bits (superior to CD quality that is 44.1Khz, 16bits) and stored in 2 to 8 channels. Bit rate reaches a 25 Megabytes per second with DVCPRO50 and DVCPRO HD as notable exceptions reaching 50 Mbps and 100 Mbps respectively.

2.2 How to recognize the different kinds of DV cassettes?

The DV family is actually divided into three types of carriers: DV, DVCAM, DVCPRO (with the three subtypes 25, 50 and HD). One can visually recognize them by their physical differences.

In this chapter we will provide a short introduction on each DV type and elaborate on some useful characteristics and features as well to properly make the difference between the three types.

2.2.1 How to recognise DV cassettes?



Fig.2. Image of the two types of DV cassettes: Medium DV and MiniDV

Sony introduced DV in 1995 as the first DV based videocassette. Later on it was manufactured by mainstream brands such as Panasonic, Maxell and TDK. Consumers as well as semi-professionals commonly used this format. In a later stage professionals such as journalists also adopted it.

- Manufacturers often used a grey shell for Medium DV and a black shell for Mini DV. Sony often used red as the colour for the tape door. However, as said earlier, this was not a strict rule amongst all manufacturers: other colours may also be used depending on the manufacturer's choice.
- DV cassettes were produced in two size versions: small, also called MiniDV, and medium.
- Main brands: Sony, Panasonic, Fuji, Maxell, JVC, Philips, Sanyo, Hitachi, Canon, Sharp, Thompson, Mitsubishi, Toshiba, TDK.
- The carrier logo is on the upper right, the brand is on the upper left. Numbers on the upper right and the lower left refer to the recording time capacity. Letters quoted ME on the lower left give information about the tape composition: 'Metal Evaporate.'

DV: physical characteristics	
Dimensions (mm)	(Small, MiniDV) 65 x 48 x 12 (Medium) 97.5 x 64.5 x 14.6
Track pitch & width (μ)	(S) 10 (M) 6,7
Tape speed (mm/s)	18,81
Recording time (min)	(S) 80, 120 (M) 180, 240
Common tape door colour code	Red, black, dark blue
Tape composition	Metal Evaporate (ME)

2.2.2 How to recognise **DVCPRO** cassettes?



Fig. 3: Image of DVCPRO25 cassettes, in two different sizes.

DVCPRO is a sub-family of DV cassettes consisting of three generations: DVCPRO25, DVCPRO50 and DVCPRO HD (also called DVCPRO 100), with the figures referring to the encoding bit rate per second. VIAA makes a difference between these carriers, which have different characteristics.



DVCPRO25

DVCPRO25 is the first version of this subtype. At the point of creation of the DVCPRO25 it was not decided yet that other generations (DVCPRO50 and DVCPRO HD) would also be created. This means that cassettes labelled with 'DVCPRO' (without a suffix) are to be considered DVCPRO25.

- Manufacturers always used a black shell for DVCPRO and a yellow colour for the tape door.
- DVCPRO25 cassettes are produced in two size versions: medium and large.
- Main brands: Panasonic, Maxell, Fuji (sometimes referred to as Fujifilm), Philips, Ikegami, Hitachi.
- The carrier logo is on the upper right, the brand is in the upper middle. Numbers on the left refer to the recording time capacity and on the bottom left is the brand-specific type name, which is of no specific use for VIAA's digitisation projects. The last two letters of this brand specific type name usually indicate the tape composition. E.g. MP stands for Metal Particle.

DVCPRO25: physical characteristics	
Dimensions (mm)	(Medium) 97,5 x 64,5 x 14,6 (Large) 125 x 78 x 14,6
Track pitch & width (μ)	(M) 18 (L) 18
Tape speed (mm/s)	33,82
Recording time (min)	(M) 66, (L) 123, 184
Common tape door colour code	Yellow
Tape composition	(MP) Metal Particle

DVCPRO50

DVCPRO50 is the second generation of DVCPRO. Just like with DVCPRO25, the number refers to the encoding bit rate (50 bit per second). Panasonic introduced DVCPRO50 in 1997 as an answer to Sony DVCAM.

- Manufacturers often used a black shell for DVCPRO50. Panasonic often used blue for the tape door. However, as said earlier, this was not a strict rule amongst all manufacturers: other colours may be used depending on the manufacturer's choice.
- DVCPRO50 cassettes are produced in one size version: medium.
- Main brands: Panasonic, Maxell, Fuji (sometimes referred to as Fujifilm), Philips, Ikegami, Hitachi.



- The carrier logo is on the upper right; the brand is on the upper left. Numbers on the upper left refer to the recording time capacity. Letters quoted MP give information about the tape composition: Metal Particle.

DVCPRO 50: physical characteristics	
Dimensions (mm)	(Medium) 97,5 x 64,5 x 14,6
Track pitch & width (μ)	(M) 18
Tape speed (mm/s)	33,82
Recording time (min)	(M) 123, 184
Common tape door colour code	Blue
Tape composition	(MP) Metal Particle

DVCPRO HD or DVCPRO100

DVCPRO HD, also called DVCPRO100, is the third generation of DVCPRO and the first DV in HD version. Like other DVCPRO types, the number refers to the encoding bit rate (100 bit per second). Panasonic introduced DVCPRO HD in 2000.

- Manufacturers often used a black shell for DVCPRO HD. Panasonic often used red for the tape door. However, as said earlier, this was not a strict rule amongst all manufacturers: other colours may be used depending on the manufacturer's choice.
 DVCPRO HD cassettes are produced in two size versions: large and extra large.
- Main brands: Panasonic, Maxell, Fuji (sometimes referred to as Fujifilm), Philips, Ikegami, Hitachi.
- The carrier logo is on the upper right; the brand is on the upper left. Numbers on the upper left refer to the recording time capacity. Letters quoted MP give information about the tape composition: 'Metal Particle'.

DVCPRO HD: physical characteristics	
Dimensions (mm)	(Large) 125 x 78 x 14,6 (Extra Large) 172 x 102 x 14,6
Track pitch & width (μ)	(L)/(XL) 18
Tape speed (mm/s)	33,82
Recording time (min)	(L)/(XL) 123,184
Common tape door color code	Red
Tape composition	(MP) Metal Particle

2.2.3 How to recognize **DVCAM** cassettes?



Fig.3. Image of DVCAM cassettes, in two sizes.

Sony created DVCAM in 1996, as the first professional version of DV format and as an answer to DVCPRO introduced earlier by Panasonic. It was used in semi-professional (industrial, educational) and professional contexts (production, broadcasting). DVCAM cassettes are usually rather easy to recognize:

- As a Sony proprietary videocassette DVCAM always has a blue tape door.
- DVCAM cassettes are produced in two size versions: small and large.
- Main brand: Sony.
- The carrier logo is on the upper right; the brand is on the upper left. Numbers in the upper right and the lower left refer to the recording time capacity. Letters quoted ME on the lower left give information about the tape composition: 'Metal Evaporate'.

DVCAM: physical characteristics	
Dimensions (mm)	(Small) 66 x 48 x 12 (Large) 125 x 78 x 14,6
Track pitch & width (μ)	(S)/(L) 15
Tape speed (mm/s)	28,215
Recording time (min)	(S) 40 (L) 184
Common tape door color code	Blue
Tape composition	(ME) Metal Evaporate



2.3 What's next?

With much more clarity on the diversity, the physical characteristics and the occurrence of these cassettes, our intern Gaël will now shift his focus towards the digitisation process itself. For VIAA to be able to issue a solid tendering specification, a whole set of technical requirements will have to be gathered. One of the most specific and important of those will be the decision on the output container, codec and specifications. As DV cassettes already contain a digital signal, this decision will be based on:

- the characteristics of the digital signal
- requirements of digital sustainability
- requirements of data efficiency in the transfer-to-file process

In the following months the main focus will be on testing different output formats, documenting and gathering expertise, so that VIAA can create a well-considered dossier for the transfer project of the DV cassettes of the VIAA content partners.

If you have any questions about this report or the project, you can contact support@viaa.be