International Association of Sound and Audiovisual Archives

Internationale Vereinigung der Schall- und audiovisuellen Archive

Association Internationale d'Archives Sonores et Audiovisuelles

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Technical Committee
Standards, Recommended Practices, and Strategies

Guidelines for the Preservation of Video Recordings

IASA-TC 06

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Guidelines for the Preservation of Video Recordings (IASA-TC 06)

Co-Edited by Carl Fleischhauer and Kevin Bradley

Edition 1, revised version, 2019

This publication provides guidance to audiovisual archivists on a professional approach to the preservation of video objects

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IASA-TC 06

Part A. Introduction

From IASA-TC 06, Edition 1
Revised version, 2019

A.1 INTRODUCTION

A.1.1 Moving image materials in the digital age

For moving image archivists, the digital age has transformed traditional categorical boundaries. In years past, motion picture *film* was strongly associated with theatrical projection and was easily differentiated from *video*, where most recordings employed magnetic tape and had a strong association with television broadcasting or playback via a display monitor. Today, it is more difficult to separate these two realms: the media and the underlying formatting have begun to converge. Digital-file-based moving image formats are strongly associated with both theatrical projection and monitor displays and the production of content for these end-user display systems is more and more similar. How will IASA-TC 06 draw the line?

The boundaries for IASA-TC 06 are influenced by the IASA Technical Committee's assessment of the most pressing preservation needs today. First, the time has come—in fact, it has nearly passed—to preserve the millions of videotapes produced from the 1970s to the early 2000s and held in archives around the world[1]. The combination of format obsolescence and an ever-shrinking number of videotape players (and the specialists needed to operate and maintain them), as well as the actual deterioration of old magnetic media, make the preservation of the content on those tapes a high priority. As noted in section A.1.2.2 below, limited resources have led IASA to publish IASA-TC 06 in phases, and the initial version will focus on the digitising of video recordings on conventional media.

The second pressing preservation need is to respond to the flood of file-based, born-digital video content that archives are acquiring today. The challenges posed by this circumstance reflect the extensive and ever-expanding variation in the digital video formats, now including 3D, high frame rates, and high dynamic range, as well as picture sizes reaching four or even eight thousand pixels on the long side. In addition, some audiovisual archives lead or participate in video production activities, especially the support of oral history and ethnographic documentation projects. The preservation response to the influx of file-based, born-digital video content calls for both strategies and methods. These "file-based, born-digital" topics are very much in scope for IASA-TC 06 but their treatment will await a future expanded version of the guideline.

Although the needs described above have shaped IASA-TC 06 (initial and future-expanded editions), the IASA Technical Committee recognizes that archives also confront preservation issues associated with motion picture film and its digital successors. Indeed, some of the preservation strategies and methods relevant to this realm overlap with the strategies and methods for "video." Nevertheless, the IASA Technical Committee feels that film and its successors deserve a guideline of their own. By the same token topics ranging from the preservation of Digital Cinema Packages, to the SMPTE DPX format, to the best preservation treatment for the REDCODE RAW (.R3D) recording format, will be left to a future IASA guideline.

1 A trailblazing 1999 survey of the archive holdings of UK and European broadcasters is summarised in *Archive Preservation and Exploitation Requirements* (Wright and Williams: 2001). This survey launched the seminal PRESTO series of audiovisual preservation projects projects (PRESTO, PrestoSpace, and PrestoPrime). The name PRESTO is derived from Preservation Technology and the landmark effort continued for more than a decade following the survey.

A.1.2 Preservation's three elements

Audiovisual preservation in the twenty-first century includes three elements:

1. **Conservation treatment and retention of original physical materials.** The following guidance is offered by IASA-TC 03[2], "Although the life of audiovisual carriers cannot be extended indefinitely, efforts must be made to preserve carriers in useable condition for as long as is feasible" (IASA-TC: 2017). This applies to many but not all collections. Some aspects of conservation are active, e.g., rehousing and cleaning materials, while other aspects are passive, e.g., placing materials in storage environments that meet recommended levels of temperature and relative humidity (IPI: 2006). When conservation is carried out by a preservation organization, it is generally done over a multi-year period and in parallel with the two elements that follow.

2. **Digitising or digitally transferring content into the form of sustainable digital data, or acquiring born digital content already in sustainable digital form**. The digital data referred to here is data that is stored in the form of computer files. It is natural to imagine, say, that the content from a single videotape will be transferred to a single master computer file. However, in some cases successful transfer or acquisition will yield a set of separate files that will be treated as a "master-file" bundle by the preservation organization. (In addition, to support access and research, archives generally also produce secondary or derivative versions in digital file-based formats.)

3. **Management of digital data over the long term.** Long-term digital preservation entails data management via *digital repositories* or *asset management systems*. The overall context for this is well described in the definition of *digital preservation* from the Association of Library Collections and Technical Services, a division of the American Library Association (ACLTS: 2009). Meanwhile, helpful models and discussion of preservation-oriented repositories are found in the Open Archival Information System (OAIS) reference model[3] and in the concepts and procedures associated with *trusted repositories*.[4] A well-rounded discussion of the topic is offered by the U.S. National Archives and Records Administration in Strategy for Preserving Digital Archival Materials (NARA: 2017).

   One of the several actions that comprise data management entails replacing—*refreshing*—the storage media (data tapes, magnetic and/or optical disks) when they become obsolescent, also known as *media migration* and *physical migration*.[5] The preceding action is part of the fundamental process

2 *The Safeguarding of the Audiovisual Heritage: Ethics, Principles and Preservation Strategy*: IASA-TC 03 (IASA-TC: 2017), p. 8.

3 ISO 14721:2012, *Space data and information transfer systems—Open archival information system (OAIS)—Reference model*.

4 ISO 16363: 2012, *Space data and information transfer systems—Audit and certification of trustworthy digital repositories*. For introductory information, see http://www.crl.edu/archiving-preservation/digital-archives/metrics-assessing-and-certifying/iso16363.

5 In the field of digital preservation, the term *migration* is used in two ways. Media or system migration refers to the movement of digital files from obsolete data-storage media or an obsolete data-management system to new media or a new system. Media migration is sometimes called *physical migration* and *media refreshment*. In this form of migration "the bits do not change." In contrast, *format migration*, also known as *logical migration*, refers the movement of a content item from one format to another: "the bits do change."

that is sometimes called *bit preservation*.[6] As the underlying data formats, e.g., video encodings, become obsolete, content may also require *format migration*, also known as *logical migration*.

A.1.2.1 Scope of IASA-TC 06

In practice, the three elements described above in section A.1.2 are mutually dependent and, in functional terms, they overlap. IASA-TC 06 provides *some discussion* of element 1, *detailed information* about element 2, while element 3 only receives *passing mention*.

The discussion of element 1, the conservation of original materials, is provided in part C, tailored to specific carriers. Readers are encouraged also to consult the IASA publication *Handling and Storage of Audio and Video Carriers, IASA-TC 05* (IASA-TC: 2014), which provides a superb counterpoint to IASA-TC 06, just as it does for IASA-TC 04.

This guideline's scope for element 2, concerning digitising and transcoding, is the subject of section A.1.5 below.

Element 3, the long-term preservation of digital data, depends upon the management and migration of data over time (and in some cases the additional provision of tools to emulate obsolete systems).[7] The preservation of digital content is not a matter of placing digital data on a carrier of a type believed to be permanent. The existence of so-called *eternal* storage media (including novel types like DNA) may offer what is called *bitstream preservation* but does not keep pace with the inevitable evolution of data formatting nor answer the need for *format migration* (aka *logical migration*).[8]

The IASA-TC 06 authors believe that the topic of digital data management warrants its own separate guideline. The implications of this topic apply to *all* digital content, not solely audiovisual collections and their *video* subclass. A compelling guideline for the long-term management of digital data also requires specialized expertise in information technology. As suggested by the footnote citations in section A.1.1 above, this topic has already received treatment in a number of other works, ranging from the U.S. National Aeronautics and Space Administration (NASA) committee that developed the OAIS model to the various digital library groups that developed the concepts, analyses, and auditing tools associated with *trusted digital repositories*.

Regarding element 3, readers associated with smaller archives are also encouraged to consult section 7 in *Guidelines on the Production and Preservation of Digital Audio Objects, IASA-TC 04* (IASA-TC: 2009). The section is titled "Small Scale Approaches to Digital Storage Systems" and it includes a description of feasible systems as well as notes about metadata, archival storage, and practical hardware arrangements.

6 Bit preservation is highlighted in *The Safeguarding of the Audiovisual Heritage: Ethics, Principles and Preservation Strategy: IASA-TC 03* (IASA-TC: 2017, p. 13), "The core actions in file-based archiving pertain to bit preservation, i.e., a set of actions that maintain the integrity of the digital data ('bitstreams') that are being managed by the responsible institution." See also the National Digital Stewardship Alliance guidance on *Levels of Digital Preservation*, developed in 2012-13 (NDSA: 2013) and being refined beginning in 2016 (Peltzman: 2016).

7 One important IASA perspective on this topic, expressed in terms of recorded sound, is provided by Dietrich Schüller's and Albrecht Häfner's analysis of the paradigm shift from eternal carrier to eternal file, summarized in http://blogs.loc.gov/digitalpreservation/2014/11/audio-for-eternity-schuller-and-hafner-look-back-at-25-years-of-change/.

8 This is not to gainsay the importance of the quality and characteristics of storage media in a data management system. Such media should have a five-to-ten-year life expectancy in order to carry digital content before refreshment (media migration) is required.

A.1.2.2 Element 2 and the phased publication of IASA-TC 06

Element 2, the digitising and/or transcoding of video content, is multifaceted, as sketched in the sections that follow. The complexity of the topic has led the IASA-TC 06 authors to draft this guideline in phases, as indicated in section A.1.4. You are reading the IASA-TC 06 *initial edition (Edition 1)*; additional information will be provided in subsequent editions. With our limited resources, we felt that it was better to address some topics now and defer others for another day.

A.1.2.2.1 Physical carriers, media dependency, and transfer as video or as data

One important dimension of element 2 concerns the physical carriers for video and the ways in which the formatting of those carriers is intertwined with the electronic information that represents picture and sound. Videotapes have existed—indeed evolved—in many sizes and shapes over fifty or more years. They may carry either analogue signal or digital bitstreams. Most videotape recordings are *media-dependent*, i.e., the formatting of the carrier and the signal that it carries are interdependent.

In order to digitise the content from a media-dependent source item, that source item, analogue or digital, must be played back in real time. For all analogue and some digital source items, playback is *as video*, a shorthand expression that means that the VTR[9] outputs information that must be digitised. This is the case for some digital videotape formats, where the digital data is "on the tape" but the output from the VTR may be analogue or in a transcoded digital stream. Transfer *as video* is contrasted with transfer *as data*, an option for some digital videotape type formats, where the underlying *bits* can be moved into computer file form without additional transcoding.[10]

A.1.2.2.2 File-based digital video recordings

In contrast to media-dependent videotape, file-based video, which only exists in digital form, contains digital bitstreams that are formatted independently of the storage media. It is true that a digital video file stored on a data tape like Linear Tape-Open (LTO) has a certain dependency on the formatting of the LTO tape. But the dependency is different in nature from the way that a video signal recorded on a 1-inch open-reel videotape depends upon proper reading of the tracks made by the helical scan heads when the tape was recorded.

A.1.3 Classes of video recordings, scope of IASA-TC 06

A.1.3.1 Six classes of video recordings: different strategies and methods

This guideline defines the following six classes of video recordings, each with its own strategies and methods to support the long-term preservation of the underlying content. Although these strategies and methods are similar and overlap, they receive separate treatment in IASA-TC 06 for the sake of clarity. In the following list, the name of the class is followed by a brief statement of method, followed by the identification of a member of the class. The six classes and their associated preservation strategies receive additional discussion in part B, section B.2 (*Preservable Objects and the Selection of Formats for Preservation*).

9 VTR is an abbreviation for video tape recorder. Although the R stands for recorder, in the context of this discussion, VTRs are employed to play back a recording.

10 It is possible to split hairs about this statement. For example, the 4:2:2 picture bitstream carried via the Serial Digital Interface (SDI) has the bits "rearranged" when the v210 data-storage structure is assembled. (More on v210 formatting in the footnote to part B, section B.3.1.2.1.) Nevertheless, this rearrangement is less drastic than, say, the transcoding applied to the proprietary Sony DigiBeta digital bitstream (on the tape) when the VTR outputs the recording to SDI in an "as video" digitisation process.

- Class 1: Analogue videotape recordings
  - Typical method: Digitisation takes a baseband output from a playback VTR, digitally encodes it, and writes to file.
  - Example: 1-inch type C.
- Class 2: Digital videotapes with encodings that are inaccessible or obsolete in terms of fitness for long-term retention (e.g., digital composite)
  - Typical method: Digitisation takes an SDI output from a playback VTR (produced by the VTR by decoding the proprietary signal and outputting to component-signal SDI), encodes it, and writes to file.
  - Example: DigiBeta (inaccessible data).
- Class 3: Digital videotapes with encodings that can be extracted "as data."
  - Typical method: Source video digital data is transferred in real-time, encoding retained as-is, then wrapped and written to file[11].
  - Example: the DV family (on tape).
- Class 4: File-based digital video source materials that warrant (early) transcoding or rewrapping.
  - Typical method: Source material is transferred faster-than-real-time, decompressed and transcoded, re-wrapped and written to file.
  - Example: a file-based Windows Media recording.
- Class 5: Authored disk-based digital recordings
  - Typical method: disk image may be produced to serve as exact copy of the source item, often considered to be the *preservation master*; secondary copy generally produced by retaining the digital encoding and re-wrapping as digital video files, often considered to be a *viewing copies* or a *production master*.[12]
  - Example: authored DVD, such as an unencrypted write-once disc from an amateur home recording.
- Class 6: File-based digital video source materials that do not warrant transcoding or rewrapping
  - Retain file as-is.
  - Example: a file-based MPEG recording in an MXF wrapper.

11 DV is the example used to define this class of source materials. However, for DV tapes, the "typical method" (copy-as-data rather than copy-as-video) might better be called the "ideal method". The classic statement of the ideal is Chris Lacinak and Dave Rice's 2009 paper "Digital Tape Preservation Strategy: Preserving Data or Video (Lacinak and Rice: 2009). During 2019, as IASA-TC 06 was being revised, a number of specialists have highlighted challenges to the ideal, a topic that will explored in the "born digital" second edition of IASA-TC 06. One challenge concerns device interface cables; see the AMIA-L listserv discussion (https://lsv.uky.edu/scripts/wa.exe?A2=AMIA-L;75010e0f.1907, accessed 5 July 2019). Meanwhile, a thorough analysis of challenges together with recommended solutions has been published by Vlaams Instituut voor Archivering (VIAA, the Flemish institute for archiving): *Wave 7: DV-based video cassettes: Draft technical specifications for the transfer to files, White Paper – v1.0* (Declercq, Fernandez, and Bubestinger-Steindl: 2019).

12 Regarding DVDs, here are two key references: (1) "Preserving Content from Authored Video DVDs," (SI Archives: 2014) and (2) *Preserving Write-Once DVDs: Producing Disk Images, Extracting Content, and Addressing Flaws and Errors* (George Blood Audio/Video: 2014). The terms used in the typical method statement for class 5 above are based on the following statement from the George Blood reference: "[The production of] ISO disc image files from the optical discs [is] a process henceforth referred to as 'cloning.' Since these ISO files contain all of the data on the disc, and retain the logical structure of this data, the Library considers these ISO files as *archival master files*. The second action, henceforth referred to as 'extracting,' is to extract the underlying digital video content from the ISO files. To the degree possible, the video and audio from the ISO files is left in the encoding 'as found"...The Library considers this extracted content to represent *production master files*" (page 4).

A.1.3.2 Main focus for initial edition: media-dependent recordings that transfer as video

For the most part, the scope for the initial edition of IASA-TC 06 is limited to class 1. But our initial-edition boundary is not surgically precise. Section C.7 describes the Betacam family of professional 1/2-inch cassettes and includes information about DigiBeta, IMX, and HDCAM/HDCAM SR. This inclusion gets IASA-TC 06 started on classes 2 and 3. Although many of the facts about the methods, target formats, and metrics for class 1 also apply to class 2, they are less applicable to class 3. Serious discussion of classes 3, 4, 5, and 6 will await the next edition of IASA-TC 06. This means that the topical boundary for the initial edition of IASA-TC 06 is a little blurry.

A.1.4 Audience and structure for IASA-TC 06

A.1.4.1 Target audiences and varying levels of detail

The IASA-TC 06 authors hope that the guideline will have high interest for a wide range of readers. We envision our archetypal reader as an archive administrator, technically sophisticated but not an engineer, who does some combination of managing a preservation-production operation (in-house activities) and selecting and managing preservation-service contractors (outsourced work).

In order to serve archive administrators and inform other motivated generalists, most sections of the initial edition of IASA-TC 06 have been written at a moderate level of abstraction. To be sure, each part includes pointers to additional and often more detailed information. We anticipate that future sections about such topics as producing new and "preservable" video footage will also be written at this level.

In contrast, however, IASA-TC 06 provides information about specific carriers—sections C.2 through C.7—at a "near-engineering-level." The authors saw significant value in providing relatively complete information about historical carriers, including pointers to additional engineering detail when appropriate. This will serve technical specialists in the field.

A.1.4.2 Introductory segments: part B

Section B.1 is tailored to the initial edition of IASA-TC 06. Titled "The Video Signal: Format and Features," this section describes the analogue video *signal*, independent of physical carriers. (To a lesser degree, this part also describes digital video *bitstreams*, a topic that will receive increased discussion in a future edition.) Video content is complex and consists of multiple elements. The planning and execution of preservation actions for video depends upon an understanding and appraisal of these elements.

Section B.2, titled "Preservable Objects and the Selection of Formats for Preservation," describes the ways in which digital data has degrees of dependency on media, and highlights the need to maximize media-independence in order to serve preservation goals. The conceptual discussion continues with comments on the production of authentic or complete copies, and defines the terms *migrating*, *digitising*, *transcoding*, and *rewrapping*.

Section B.3, titled "Target Formats for Video Recordings to Be Digitised 'as Video' in Real Time," pertains to the formats to be used for preservation master files. When we digitise, transcode, or rewrap our video *inputs*, what digital-file-based formats ought we seek as *outputs*? In the initial edition of IASA-TC 06, the focus is on formats that make a good fit for digitising recordings from the conventional carriers associated with classes 1 and 2.

A.1.4.3 Descriptions of selected videotape types: part C

The initial edition of IASA-TC 06 focuses on conventional carriers that require real-time playback and emphasizes source recordings that must be transferred "as video." Preceded by introductory information, sections C.2 though C.7 describe six widely held carriers (or "carrier families") that are preservation priorities for many archives. Drafted by experienced engineers and video specialists, these sections note (a) how each carrier should be prepared for playback or data transfer, (b) how to select the best copy when more than one is available, and (c) how to select and adjust players for the best output (i.e., the "input" to the digitising system).

C.1 Introduction to Carriers; Assessment, Preparation, and Cleaning
C.2 Quadruplex 2-inch Reels
C.3 EIAJ and Sony CV ½-inch Open Reel Videotapes
C.4 1-inch Helical-Scan Open Reel Videotapes (types A, B, C)
C.5 U-matic ¾-inch Videocassettes
C.6 ½-inch Analogue Consumer and Semi-Professional Videocassettes
C.7 Betacam ½-inch Professional Videocassette Family

A.1.4.4 Workflow, device and system performance: part D

This section provides an overview of workflows and systems that support the digitising of the types of carriers described in the preceding sections. The discussion characterizes the possibilities for, and limits to, metrics and testing that will help ensure that equipment and systems are suitable and performing correctly, or that a suitable vendor is selected. This topic also supports the monitoring of production processes and outputs, i.e., quality assurance and quality control.

A.1.4.5 Bibliography: part E

This section contains a three-part bibliography:

E.1 General bibliography of works cited and other selected works
E.2 Selected glossaries
E.3 Wikipedia articles

A.1.5 Guiding principles for digital preservation master files[13]

Although IASA-TC 06 provides information about the care, handling, and storage of selected physical video carriers, the guideline's emphasis is on the digital context and on the processes associated with the preparation of digital video data that is sustainable for the long-term. Regarding the digital files produced to support preservation, the IASA working group was guided by the three principles that are summarized here and elaborated upon in the paragraphs that follow. The master digital files produced to support preservation should:

1. Be authentic and complete copies of the original recordings, including such components as multiple time codes, captioning, and soundtracks.
2. Represent very high levels of quality in terms of the reproduction of picture and sound.
3. Support access by future users.

These and other principles receive additional elaboration in *The Safeguarding of the Audiovisual Heritage: Ethics, Principles and Preservation Strategy, IASA-TC 03* (IASA-TC: 2017).

13 This section owes a debt to "Digital File Formats for Videotape Reformatting: Part 5. Narrative and Summary Tables" (FADGI: 2014b).

A.1.5.1 Digital master files: authentic and complete copies

To meet the goal of file-based carriage for the sake of preservation, archives require a file or a bundle of files that carry the multiple elements that comprise an item of video content, as described in part B of this guideline and sometimes referred to as the video *payload*. In each instance, an archive may appraise materials to identify the segments of the payload that are essential to retain. It may or may not be necessary, for example, for an archive to ensure that all of the time code data embedded in a source item be brought forward into the new digitised master. Or, to pick another example, it may or may not be necessary to retain the four separate sound tracks from the source recording; in some cases, an archive may decide that they can be safely be mixed to stereo.

To appraise materials in terms of elements like those named in the preceding paragraph, an archivist examines two factors. The first requires understanding the makeup of the video content at hand, assessing the elements in the payload. To weigh the second factor, the archivist must look at the archive's typical users (what the OAIS Reference Model calls the "designated user community")[14] and the needs they bring to collections. What might a researcher require? To use the time code example, will there be researchers who perform forensic analyses that will benefit from the ability to trace video footage back to an earlier source? What might a person seeking to repurpose footage for a new video program require? Will that producer, for example, wish to remix the four soundtracks for a certain effect when a segment of the preserved footage is incorporated in the new production? Judgments about these and similar matters are an "archivist's call," and not the business of this technical guideline. This guideline, however, must provide the facts and methods that serve those who seek to retain multiple payload elements in the copies they produce in the name of preservation. We are not prescriptive regarding curation, retention, management, or processes, but rather seek to provide the technical knowledge and tools that archivists require in order act on their professional appraisal and judgment.

A.1.5.2 Digital master files: reproduction quality

In general, professional archivists prefer preservation-master file formats that maximize quality in both picture and audio reproduction, generally as uncompressed or losslessly compressed essences.[15] With older source recordings, however, this does not mean that original signal is retained without changes that affect look and feel. For example, almost all analogue videotapes contain *composite* video recordings in PAL, SECAM, or NTSC systems,[16] and the relevant specifications must be observed in order to achieve proper playback. Meanwhile, all of the digital encoding formats as targets—where the new digitised payload will be recorded for the future—employ *colour-difference component* video. When an old tape is played back, before it can

14 ISO 14721:2012, *Space data and information transfer systems—Open archival information system (OAIS)—Reference model*.

15 Broadcast professionals and some archivists use the term *essence* in a slightly loose (and thus variable) manner. The terms in use here will be refined for eventual inclusion in an IASA-TC 06 glossary; this footnote is a placeholder. (An identical footnote is holding place in section B.1.4.2.3.) These definitions are based upon (and are revisions of) the glossary in Richard Hopper's *EBU Project Group P/META Metadata Exchange Standards* (Hopper: 2000). In Hopper's EBU document, *essence* is defined as "the audio, graphic or text itself—the physical output which can be heard or seen by the consumer"; *metadata* is "the information or data that identifies and describes associated essence"; *content* is essence plus metadata (p. 25). Other EBU P/META definitions include *media object* and *media asset*, which are combination entities (p. 25), in effect content-plus-wrapper, thus including metadata; the glossary highlights rights metadata, important to broadcasters; media objects or assets represent content that can be stored and/or played.

16 These signal systems are described in B.1 and B.2.

be encoded and written to a file, it undergoes an irreversible transformation from composite to component colour models.[17]

A.1.5.3 Digital master files: support for sustainability and future access

Support for future access has two dimensions. The first is technical and can be summarized with this question, "Will I be able to decode and interpret this stream of bits in the future?" Archives seek formats with long life expectancy, even as they recognize the need to carry out format migrations over time. Success in this area is related to a number of factors sometimes referred to as *format sustainability*, a topic that is discussed in section B.2, *Preservable Objects and the Selection of Formats for Preservation*.

The second dimension has to do with the retention and (in some cases) the fresh encoding of the types of ancillary and associated data described in section B.2, *The Video Signal: Format and Features*. Decisions in this area are, again, an "archivist's call." When digitising a recording with binary closed captioning or subtitles, for example, an archive can choose a method selecting a format that permits the movement and storage of a copy of this textual captioning data as, say, XML, thereby providing a version that can be more easily extracted for indexing, just as having an OCR[18] rendering of a book text means that the book can be indexed in order to be more accessible to researchers, via text searching.

17 A certain level of transformation is also experienced when transferring certain types of sound recordings. Ross Garrett, Audio Services Team Leader at the National Film and Sound Archive of Australia, wrote that, when digitising sound, the operator will rarely or never have "the exact styli, pre-amp-eq curve, weight, cut of disc, amount of vibration, listening environment, cabling, hearing loss, etc., for meticulous reproduction of analogue items...but we can offer the best known or common practice" (personal communication, 27 August 2017).

18 OCR stands for *Optical Character Recognition*, the conversion of scanned images of typed, handwritten, or printed text into machine-encoded (and hence, searchable) text.