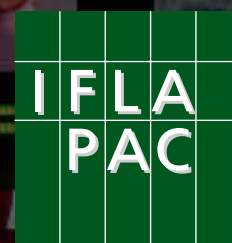


International Preservation News

A Newsletter of the IFLA Core Activity
on Preservation and Conservation



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**Preservation of Audiovisual
Collections
Moving Images**

INTERNATIONAL PRESERVATION NEWS

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is a publication of the International Federation of Library Associations and Institutions (IFLA) Core Activity on Preservation and Conservation (PAC) that reports on the preservation activities and events that support efforts to preserve materials in the world's libraries and archives.

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In our last issue on December 2008, we wanted to shed some lights on the preservation of photography and sound recordings, collections which are parts of the libraries heritage, often on an equal footing with books. On this subject, the review *A rayons ouverts, Chroniques de Bibliothèque et Archives nationales du Québec*, proposes an excellent survey on Sound and Image (N° 78).

In this first issue of 2009, we go on presenting the preservation of audiovisual collections with a focus on moving images.

Some of our readers can wonder how the archives of film, TV, radio or Web can influence the world of the preservation of written heritage. We have to remember that, in several countries, the national library or the archives are also the place where many other supports than paper or

photos are preserved. During my visits, in Africa in particular, I noticed that we could find, next to books, video cassettes, TV archives in the form of tapes, film archives, etc. More generally, nowadays, the field of information and documentation is facing a digital revolution, which can't be reduced to a simple revolution of support.

Europeana and World Digital Library are showing the way: the libraries of the future will preserve texts, images and sound, Web, TV, film archives. The demand for consulting the television archives is very strong, as the phenomenal success, in France, of the Ina website (French National Institute of Audiovisual) proves it. This access to moving images which will necessarily have to coexist in our catalogues with access to texts (even parts of texts) triggers a revolution in our traditional OPAC. Finally the transition to the all-digital planned for 2010 regarding television will have a domino effect for all the collections, following in the audiovisual archives' footsteps.

In addition to this special survey, you will find your usual sections. In the first half of 2009, the IFLA website – proposing our review on line – will know a deep change. The opportunity, we hope, for us to circulate in a near future, on-line and more often, news and on-time information (conferences, meetings, alas disasters requiring a support) and more images.

As every time, I incite you to propose us articles and information but also to promote the review around you: we would like to remind you that it can be sent free of charge to all interested persons.

Christiane Baryla
Directeur d'IFLA-PAC



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Dans notre numéro de décembre 2008, nous avons souhaité apporter quelques éclairages à propos de la conservation de la photographie et des enregistrements sonores, collections qui font partie du patrimoine des bibliothèques souvent à égalité avec les livres. A ce sujet, *A rayons ouverts, Chroniques de Bibliothèque et Archives nationales du Québec* présente dans son numéro 78 un excellent dossier « Son et Image ».

Dans ce premier numéro de l'année 2009 nous poursuivons la présentation de notre dossier audiovisuel avec les images animées.

Certains, parmi nos lecteurs, pourront se demander en quoi les archives du film, les archives TV, radio ou Web influencent le monde de la conservation de l'écrit. Rappelons que, dans nombre de pays, la bibliothèque nationale ou les archives sont aussi le lieu où l'on conserve bien d'autres supports que le papier ou des photos. Lors de mes visites, en Afrique notamment, il m'est arrivé de constater qu'à côté des livres, on pouvait rencontrer des cassettes vidéo, des archives TV sous forme de bandes magnétiques, des archives film, etc. Plus généralement nous assistons aujourd'hui dans le domaine de l'information et de la documentation à une révolution, celle du numérique, qui va bien au-delà d'une simple révolution de support.

On le constate avec Europeana ou la World Digital Library : les bibliothèques du futur conserveront des textes, des images et du son, des archives Web, TV, film. On peut constater une très forte demande de consultation de ces archives télévisuelles : le succès phénoménal, en France, du site de l'Ina en est la preuve. Ces accès à l'image animée qui devront forcément coexister dans nos catalogues avec des accès aux textes (voire à des parties de textes) entraînent une révolution dans nos OPAC traditionnels. Enfin le passage au tout numérique qui va s'achever dès 2010 pour la télévision aura un effet d'entraînement pour toutes les collections, dans la lignée des archives audiovisuelles.

A la suite de ce dossier vous retrouverez vos rubriques habituelles. Le premier semestre 2009 verra une profonde transformation du site Web de l'IFLA sur lequel notre revue est également disponible. A cette occasion, nous espérons, dans un avenir proche, pouvoir vous proposer, en ligne et plus souvent, des nouvelles et des informations ponctuelles (colloques, rencontres, hélas catastrophes nécessitant un soutien) et davantage d'images.

Comme chaque fois, je vous incite à nous adresser des articles et des informations mais aussi à faire connaître notre revue autour de vous : rappelons qu'elle peut être envoyée gratuitement à tous ceux qui le désirent.

Christiane Barylà
Directeur d'IFLA-PAC

Video Archiving and the Dilemma of Data Compression

by Dr.phil. Dietrich Schüller, Special Preservation Projects
Phonogrammarchiv, Austrian Academy of Sciences

The ethical aim of archives is to preserve the information placed in their care. Despite a number of problems, this is generally possible with text documents. For machine readable documents, however, amongst them audio and video recordings, the long-term safeguarding of the originals is not possible. Preservation must, therefore, concentrate on the content of the carriers. This principle is accepted and implemented in professional long-term audio preservation. Video preservation is, however, faced with the problems created by the very large amounts of data that will require subsequent copying if the example of the audio world is to be followed. While, at present, data compression is widely applied in video archiving – a practice that is not, in the narrower sense, archival – memory institutions and audiovisual research archives are beginning to explore uncompromising, non-compressed video archiving, which logistically and financially has become a viable option.

With regards to their long-term preservation, audio and video recordings are twins: none of their formats and carriers has been developed for stability over longer periods, and both types of documents are dependent on the availability of equipment which, in the course of technical development, has reached considerable levels of sophistication. Moreover, the ever accelerating pace of technological development has led to ever shorter commercial life cycles. This is particularly true of magnetic tape based video formats, many of which have been superseded by a follower format after only a few years. Format obsolescence swiftly leads to fading of maintenance support and spare part supply by manufacturers, which leaves even well preserved media irretrievable because of a lack of working playback machines.

Around 1990, the answer of sound archives was to give up the traditional paradigm of safeguarding the original carrier as this would have meant, apart from the problems of preserving carriers in a stable condition, keeping warehouses of format specific replay equipment and their spare parts to ensure retrievability of contents. *Preserve the content, not the carrier* – was the new philosophy, based on the digitisation of analogue content and the subsequent migration of content from one digital preservation platform to the next. By 1992/93, this new concept had paved the way to the development of Digital Mass Storage Systems (DMSSs), which permitted automated data integrity checking, refreshing and, ultimately, migration to new systems with a minimum of manual labour. Radio archives were the driving force, envisaging predominantly remote access to their archives – a feature which has since totally changed programme production methods.

The development of professional long-term audio preservation was, almost from its onset, governed by two constituent elements:

- the avoidance of data reduction algorithms, often termed (lossy) compression¹, and
- the use of true file formats, as opposed to (proprietary) data streams.

A key factor in this development was the *European Broadcasting Union (EBU)*, who expanded the Microsoft Wave format (.wav) into the *Broadcast Wave Format (BWF)* by adding a “chunk”, a header, to accommodate a limited amount of metadata. Through this action and the general acceptance of the BWF format by radio sound archives, Wave has become an international de-facto standard as a linear (= un-“compressed”) audio file format in archival applications for long-term preservation².

It is estimated that since its introduction in the mid-1990s onward, the worldwide archival stocks of archival files in Wave format amount to several tens of million hours. With the rapid disappearance of early audio streaming formats (DASH, ProDigi, R-Dat, etc.), Wave has meanwhile become the almost exclusive format used in production. Thus audio production, processing, and archiving have become part of the IT world.

Video has so far developed in another way. Several analogue as well as digital professional and home formats have been developed with ever shorter life cycles. This has led to the creation of severe preservation problems because of the obsolescence of equipment. Even in pre-digital times, equipment obsolescence had forced television archives to copy tapes. For example, two inch originals to the one inch format and later to professional half inch component formats like Betacam SP. Because of generation losses in the analogue copying processes, this resulted in a loss of quality in the target formats. The driving forces for this copying process were the obsolescence of replay equipment and the ease of use of the much smaller target formats.

The first digital formats, developed from the mid-1980s onward, were all linear formats which, theoretically, would

1. The jargon associated with the development and use of these algorithms is linguistically misleading. “Compression” semantically describes an increase in packing density of a defined amount of units; by expansion this amount remains unchanged. Experts, probably those active in the Joint Photographic Experts Group (JPEG) and the Moving Picture Experts Group (MPEG), have sloppily applied this term for perceptually encoded data reduced encoding schemes (“codecs”), which then had forced them to distinguish between “lossy” and “lossless” compression. In 1992, the Technical Committee of the International Association of Sound and Audiovisual Archives (IASA TC) criticised this misleading terminology, which may have helped to establish the terms “data reduction” and “data reduced” in place of “lossy compression” in the realm of audio archiving.

2. IASA TC has codified audio archiving principles in document *IASA-TC 03* in 1997, which is now in its 3rd version. A similar standard for video does not (yet) exist.

have kept the quality of analogue originals copied onto them³. However, all these early digital formats are now obsolete and several archives are facing difficulties with the migration of the content of these early digital video tapes because of a shortage of working replay machine. Video archiving did not follow the path of audio archives that had digitised their holdings by using the linear Wave format and storing the files in mass storage systems. They continued to rely on proprietary production formats. This was in part because of the sheer quantity of digital data which, at the time, was too costly to be kept in IT environments, and partly to keep production and archival formats identical for practical reasons. This would not have been a major obstacle to the use of archival principles similar to those developed by the audio archives world. However, commercial pressures led to the widespread use of “compressed”, i.e. data reduced, formats for professional and home video recordings.

Data reduction/compression for audio, images, and video was developed from the 1980s onward in order to reduce the quantity of digital data for storage and transmission. After some dispute, perceptually encoded audio like MPEG1 Audio Layer 2 (“Musicam”), developed for digital broadcast, and MPEG1 Audio Layer 3 (“MP3”), developed mainly for internet distribution, were declared to be opposed to audio archival principles. This was because all encoding schemes (*codecs*) are, to some degree, imperfect and a considerable part of the original information is deliberately deleted and irretrievably lost. In view of the large size of digital video signals, however, the possibility of considerably reducing video data bit rates and storage requirements was too tempting to be rejected for production and archiving. The most prominent hindrance to the introduction of true archival standards for video storage was the cost of digital storage space in the 1990s.

The first group of compressed video formats, amongst them DigiBeta for professional and DV for home use, made use of *intraframe compression* only, which is based on spatial redundancy. Each frame (actually each “field”) is compressed on the basis of psychophysical phenomena, which allow a reduction of data - with DigiBeta reducing the data stream to one half of its original size and with DV to one tenth - without significantly reducing the subjective perceived image quality. With further technical development, basically with the increase of signal processing speed, additional data reducing effects were introduced by extending coding to *interframe compression*, based on temporal redundancy. Only few frames are fully defined (so-called I-frames), while the rest of the frames is defined by their differences against the I-frames. On this basis, different *codecs* with different levels of complexity have been developed for video. MPEG1, 2 and more recently 4 allowed a further dramatic reduction of data. Standard definition (SD) television production is predominantly based on MPEG2 formats at 50 Mbit/s, while the DVD, also MPEG2 encoded, works with a variable bit rate averaging at 6 Mbit/s. MPEG4, more powerful than MPEG2, is used to improve internet quality at

low bit rates but also to keep high definition (HD) data streams at comparatively moderate levels. H.264 is a recently developed powerful *codec* within the MPEG4 family which, *inter alia*, permits the use of consumer handycams for HD signals.

All MPEG based *interframe compression* formats are perceived – if bit rates are high enough – at a quality standard that generally subjectively matches the quality of linear, i.e. uncompressed signals. The disadvantages are, as with all data reduced audio and video *codecs*, limitations in the post processing (editing) of such signals and also in error correction capability in the event of data corruption.

There is, however, an additional limitation associated with *interframe compression*: while the quality of the moving images (at adequate bit rates) is perceived without significant loss of quality, this is not the case when examining single frames. This disadvantage is acceptable in the normal use of video-grams as *moving images* e.g. for entertainment. Video documents, however, are playing an increasingly significant role as research documents for many

scholarly disciplines such as ethnomusicology, anthropology, dance and ritual studies. More recently, linguistics studies were added to this list. Because of the availability of affordable video technology, the role of gestures has been included in their systematic studies. The solution of many scientific questions in these disciplines relies on single frame analysis. However, single frame representation in MPEG2 may be blurred, which may have significant influence on the usability of such encoded signals for scientific evaluation⁴.

In order to avoid this and other dilemmas in the preservation process of video research footage, audiovisual research archives wish to preserve video signals in full archival terms, following the universally accepted model of audio archiving⁵. Standardisation of video data streams within the MXF wrapper furthered that development. Additionally, the dramatic drop in storage prices for hard disks drives and computer back-up tapes⁶ in recent years has made these endeavours financially viable. The Vienna Phonogrammarchiv was probably the first, starting in 2001. This was followed by other research institutions including EVIA (Ethnographic Video for Instruction and Analysis), an online video research archive in Bloomington, USA, and the Max Planck Institute for Psycholinguistics in Nijmegen, Netherlands.

Further support for this development came with the availability of the compression format Motion-JPEG (MJPEG) 2000 in its lossless version, which, as a code regenerating format, is in compliance with archival standards. It has become widely used in still image preservation due to its superior mathematical (wavelet-)algorithm. It has also become the standard format for

3. These formats were D1 and D5, component formats that meet ITU 601, and the composite formats D2 and D3. ITU 601 defines the full quality digital SD signal in 4.2.2 component representation. Data rate is 270Mbit/s, storage space requirement between 80-100 GB/hour. Digital composite formats had a data rate of 140Mbit/s requiring approximately 45-50 GB per hour.

4. Degradation of single frames depends on the bit rate. An exception is, however, if MPEG2 “I-frames-only-coding” is used at high bit rates (50 Mbit/s).

5. Following archival principles in video archiving would mean that all analogue video formats be brought to ITU 601. Digital video signals originating in “compressed” formats should be kept in this original encoding, if at all possible, as transcoding to other *codecs* is ultimately associated with content alteration. This is possible e.g. for DV signals within the MXF wrapper.

6. In the course of the past decade, LTO (Linear Tape Open) computer back-up tape has gained universal popularity at ever decreasing costs for tape drives and media.

digital cinema, making the handling of their storage requirements, which significantly exceed even HD television signals, a viable operation. Lossless MJPEG 2000 reduces storage requirements by up to one third of the uncompressed signal. ITU 601, the full quality SD signal can, therefore, be stored at approximately 35-50 GB per hour. The use of MJPEG 2000 as an archival target format is widely discussed by audiovisual archivists, and was a prominent topic at JTS 2007⁷ in Toronto. With rapidly falling storage costs, however, there are voices that question the advantage of reduced storage space at the expense of several possible disadvantages⁸. However, the world of television archives has not yet significantly moved in this direction.

What consequences can be drawn from this present situation?

Television archives may continue to follow their policy of transferring content from obsolete video formats to production formats. For SD signals this is, at present, to MPEG2 formats, generally at 50Mbit/s. This is not *archival* in the narrower sense of the term. However, television archives are part of commercial enterprises and not of memory institutions like museums, libraries and archives proper. They can hardly be blamed for pursuing such policy, as lossy video formats do not, in general, hamper the viewing quality of television programmes. They can justifiably argue that possible restrictions in the authenticity of

content details, which may be deplorable from an archival point of view, could only be avoided at the expense of their business driven institutions, which would be outside their mission and scope.

Audiovisual research collections and memory institutions, however, have to follow a different policy. To date, uncompromising linear (=non-compressed) video file archiving has grown beyond infancy and will spread steadily. Dedicated research institutions and major (national) audiovisual collections will embark on this policy as digital storage costs continue to drop and, hopefully, more hard- and software suppliers will develop workstations and tools specifically dedicated to archiving. Other institutions may wish to wait until service providers extend their professional services also by offering uncompromising video archiving.

Finally, it is not unrealistic to predict that video production will, sooner or later, follow the example of audio by leaving proprietary compressed formats behind and change to file formats that can be stored in linear or losslessly compressed form in digital mass storage systems. Further decreases in storage costs will make such a policy viable also for HD signals. Once that has happened, television archivists will regret that so many analogue and early linear digital video originals have been "preserved" in a different and less flexible way.

Acknowledgement:

The author is indebted to Franz Pavuza, Phonogrammarchiv, and Carl Fleischhauer, Library of Congress, for their support in the discussion of the most recent development.

7. The Joint Technical Symposium (JTS) is organised approximately every 3 years by CCAAA, the Co-ordinating Council of Audiovisual Archives Associations. The Proceedings of JTS 2007 are awaited.

8. In the United States, this issue is, *inter alia*, discussed by the Audio-Visual Working Group within the *Federal Agencies Digitization Guidelines Initiative*. <http://www.digitizationguidelines.gov/audio-visual>

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El archivado de videos y el dilema de la compresión de datos

El objetivo ético de los archivos es preservar la información entregada a su cuidado. A pesar de algunos problemas, generalmente es posible con los textos. Sin embargo, en el caso de los documentos que requieren equipos para su lectura, entre los que se encuentran las grabaciones de audio y video, no es posible el resguardo de los originales a largo plazo. La preservación debe, por lo tanto, concentrarse en el contenido de los portadores. Este principio se acepta y se aplica en la preservación de audio a largo plazo. Sin embargo, la preservación del video enfrentó los problemas creados por las grandes cantidades de datos que requerirán un copiado posterior si no se sigue el ejemplo del mundo del audio. Mientras que, en el presente, la compresión de datos se aplica ampliamente en el archivado de videos – práctica que en el sentido más estricto no es de archivo – las instituciones responsables de la memoria y los archivos de investigación audiovisual están comenzando a explorar el archivado de video no comprimido, lo cual se ha convertido en una opción viable desde el punto logístico y financiero.

Presto – PrestoSpace – PrestoPRIME

I by **Daniel Teruggi**, Head of Research Department, Ina, Bry sur Marne, France

The “Presto” projects have, since 2000, launched a strong action towards preservation of audiovisual contents. PrestoSpace, which run from 2004 to 2008, proposed tools and strategies for an integrated approach to the whole audiovisual preservation process. The recently initiated PrestoPRIME, deals with strategies and solutions for keeping digital contents alive on the very long term, as well as initiating a Competence Centre dedicated to Digital preservation.

Presto – PrestoSpace

The context

There is an urgency concerning audiovisual archives; the problems are well known and understood however there is a certain lack of action when it comes to making decisions about preservation of analogue and digital contents. The decisions are difficult for any archive responsible and the solutions available often complex or uncertain; this is why there has been in the past a strong tendency to wait and see how technology evolves and what new solutions it may bring. In the meantime physical decay and technology obsolescence slowly make the contents unavailable or imply an enormous effort in order to save them. This is why we live in the rim of a crucial moment, where large chunks of our audiovisual past are at risk of being lost and where still not enough actions are undertaken in order to keep the contents alive.

At the end of the nineties, some large broadcast archives starting taking important initiatives in order to transfer analogue content to digital carriers, since they had started having problems with carrier degradation. Very quickly the complexity and the high cost of the transfer showed the necessity of launching ambitious preservation plans on the long term if contents wanted to be preserved. Broadcast archives represented a good place where to measure carrier and content degradation; the regular use or archived material for new programs or to fill broadcast spaces, implied a regular access to the archive and permitted to get a feedback on the state of the archive.

The necessity for quick action brought archives together in order to initiate a technological cooperation that would permit to accelerate and optimise the actions needed to attempt an audiovisual preservation of the audiovisual heritage. It was under great risk of loss, and with real problems witnessed day after day. Thus was born the Presto project which run from 2000 to 2002, followed by PrestoSpace, which run from 2004 to 2008 and is now being continued by PrestoPRIME, which started in January 2009 and will run until mid 2012.

A first attempt: the Presto project

While launching preservation plans and fighting for government funding, three large broadcast archives: BBC, Ina and RAI

(institutions which dispose of a research department), started working together in order to tackle the obsolescence of media and the high costs of transfer. They joined together in the EU funded IST FP5 Presto¹ project where they were the leading partners, with the objective of developing cost-effective technology and processes for audiovisual media.

Main partners of the project:

BBC Information and Archives, coordinator of the project, with Richard Wright as project manager

INA - Institut National de l'Audiovisuel, Bry Sur Marne, France

RAI - Radiotelevisione Italiana - Main Archive, Rome, Italy
Research and Technology Innovation Centre, Turin, Italy

Technical partners:

Advanced Computer Systems, Rome, Italy

e-vod, Levallois, Perret, France

Istituto Trentino di Cultura, Trento, Italy

JOANNEUM RESEARCH, Graz, Austria

NTEC Media GmbH, Potsdam, Germany

Snell and Wilcox Limited, Petersfield, UK

VectraCom, Montreuil, France

User Group:

NAA Netherlands Audiovisual Archive (afterwards named B&G)

NRK Norwegian Broadcast Archive

ORF Austrian Broadcast Archive

TRT Turkish Broadcast Archive

SVT Swedish TV Archive

SWR Suedwestrundfunk Broadcast Archive, German Television

YLE Finnish Broadcast Archive

The project produced a very important set of technical and industrial results², which permitted to optimise and accelerate the transfer process for audio, video and film. It also started a survey on broadcast holdings in order to evaluate the volume of European contents, with a first estimation of 5 million hours of material in the three domains for 10 archives, which permitted to extrapolate the amount of 100 million hours in Europe if all audiovisual archives were included. This survey gave a dimension of the amount of investment necessary and the fact that important cost reductions were to be applied in order to achieve that objective.

Furthermore, and probably one of the most important conclusions, an industrial processing approach, where manual object handling would be limited, where software quality control would be applied and where a global management of the process would be installed, could bring substantial economies to the whole process, ranging from 50% to 70% of economies in regards to current costs.

Presto was indeed the first step to evaluate, understand and define solutions for analogue to digital transfer of audiovisual

1. Presto: Preservation Technology for Broadcast Archives

2. For information about the results, visit:

<http://presto.joanneum.at/index.asp>

material while giving the dimension of the effort that would be needed at a European level in order to achieve effective preservation of the holdings.

PrestoSpace: an integrated approach towards audiovisual digitisation

Presto was a very important landmark for the participating archives; it gave them a long-term vision of what was there to be done and useful indications on the methods and processes needed in order to advance. It also gave them important information to plan the future actions and to seek for national funding in order to develop their ambitious preservation plans.

However the wide comprehension of the problems involved in digitisation and access to contents, established another fact: it would be very difficult, if not impossible, for small and medium archives to survive in the digital world unless strong actions were undertaken to assist, organise and provide technology and methodology to develop efficient preservation plans. It was also important to find business models and funding issues that would help small archives in what seemed an impossible quest.

The results of Presto, mainly concerning the industrial approach or “factory” approach and the situation of most archives in the audiovisual domain, were one of the strong incentives to launch a new project, more ambitious which would not only permit to develop this approach but would also take into account all the actions needed to transform an analogue content into a digital archive, restored, documented and publishable. It would promote the Factory approach in order to accelerate, diminish costs and improve the quality of the preservation process. Thus PrestoSpace was initiated, bringing together in an EU funded FP6 Integrated Project; Audiovisual archives, Industrials, Academics and Service Providers, in order to construct a strong network of resources and tools to accelerate audiovisual preservation.

The project worked on all the actions that intervene in the digitising process, in order to find in each domain new solutions or substantial improvements. The project was in consequence structured in 4 work areas, dealing with the main actions within the preservation and digitisation chain:

- **Preservation Work Area:** developing tools to improve media playback, assess the media state and organise the preservation process.
- **Restoration Work Area:** correction algorithms for real-time and disk-based restoration.
- **Storage and Archive Management Work Area:** planning, financial and management tasks for preservation process and storage technology aspects.
- **Metadata, Access, and Delivery Work Area:** tools for metadata extraction and structuring, ensuring proper delivery to the archives.

In parallel to these work areas, transversal Workpackages permitted to articulate the project internally and in regards to the outside world, they concerned: User Requirements, System Architecture & Specifications, Integration of results, Services, Exploitation & Tests.

User groups were organised to understand their problems and experiment with intermediate developments. The main user groups concerned Audiovisual archives, composed of 180

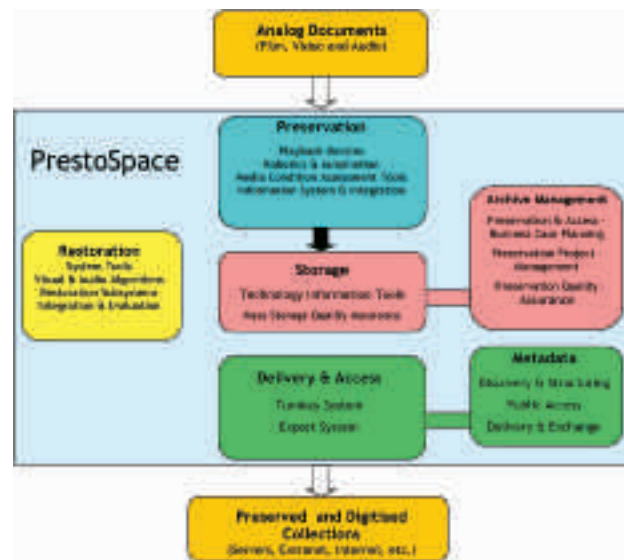


Fig 1. The structure of the project, with its different work areas.

members from 52 countries and the Service Provider Group, composed by 144 members in 26 countries. Continuous dissemination and training actions as well as tests were undertaken with these user-groups to verify and get strong feedback about the developments.

These transversal Workpackages operated at the project level, keeping a view on all the developments of the project. They had the major task of verifying that the results were interoperable and easily interconnected.

The Partners of PrestoSpace

Archives, Service providers, Industrials, Universities and applied research Institutes from 8 European countries and the US, participated to the project. The partners contributed to address directly the archiving problems, to implement the results of research and to build the tools and components for the preservation chain, for restoration innovations and for access solutions.

- 8 archive institutions and their R&D departments: INA, BBC, B&G, ORF, RAI, Netherlands Film Museum, Österreichischer Mediatek and NOB.
- 3 applied R&D institutions: Joanneum Research, CRCDG-CNRS, IT Innovation.
- 6 universities: University of Sheffield, Gdansk University, Surrey University, Trinity College Dublin, Université de La Rochelle, University Roma Tor Vergata.
- 15 industrial partners, all of them are SMEs: ACS, Indeeep, Eurix, CubeTec, Hi-Stor, HS-Art digital, Centrimage, Sirma AI Ltd, Media-Matters (US), Snell&Wilcox, SSL, StreamUK, TI Partners, Studio Hamburg, Vectracom.

The 35 partners of the project were outstanding actors of the Audiovisual domain and contributed strongly to the success of the project bringing together the critical mass necessary to solve major preservation problems. The cost of the project was of 15M€, where 8M€ were brought by the European Commission.

The results of the project³

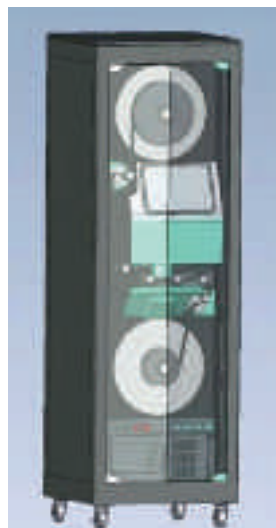
Each work area or domain of the project produced important results a majority of which have become or will become industrial

3. All the results can be found at: www.prestospace.eu

products. Parallel to the technological developments the strong exchange with the Archive and Service Provider community permitted to understand the underlying organisational and funding problems and to propose a new concept institution for providing guidance to Audiovisual Archives: the Competence Centre.

Preservation

A fast, affordable Datacine, a Contact-less Playback Tool for audio disks, an Audio-tape magnet-optical playback tool, an Automated Video Preservation tool, a Manual tape condition assessment tool and an Information System for Preservation Management.



A fast affordable Datacine: specific Datacine for archive films, sprocket-less, very gentle to film (even damaged), robust to archive film impairments (shrinkage, aged tape splices, curling, damaged sprocket holes). It will be commercialised by P+S TECKNIK, Munich in October 2009.

Fig 2: PrestoSpace Datacine prototype.

A Contact-less Playback Tool for audio disks: reading audio disks without touching them, simple setup and no risk for the disk. Reduced crackle : reduced cleaning requirements, robustness to scratches and lacquer cracks. Developed by Ina and commercialised by Indeep.



Fig 3. Prototype of the system to be commercialised by Indeep in October 2009.



An Audio-tape magneto-optical playback tool: efficient to all tape speeds, stereo/dual channel tapes, 1 to 4 tracks, reverse tracks, tracks position, automatic head azimuth adjusting, detection and correction of drop-outs.

Fig 4. Prototype of the audio-tape playback system developed by Reply and Hi-Stor.

An Automated Video Preservation tool: uses **robotics** and **customised** software and hardware to **migrate large quantities** of cassette contents, lower cost, higher speed, higher quality, automated migration done on-site, robotic tape handling, robotics/signal/video/audio monitoring, proprietary tape cleaning correction technologies, proprietary time-base correction, migrates to :

- Digital Media files - Mpeg2, Mpeg4, Windows Media, MJPEG2000 (World's first hardware-based MJPEG2K encoding system);
- + traditional videotape (if desired) at the same time.



Fig 5. Robot and control system developed by Media Matters and commercialised under the name of Samma System.

A Manual tape condition assessment tool and An Information System for Preservation Management: these two developments are essential blocks for determining the state of the audiovisual collections in function of the brand of the tapes and the year of fabrication, and the Information System, called Prefactis, permits to follow all the linked processes within a preservation chain and verify the correct preservation status and the location of the physical and digital objects.

Restoration

Based on existing restoration environments, the project developed a large set of restoration tools, improving the state of art regarding defects that couldn't be dealt with up to know and improving the quality of restoration.

Restoration management tool: this generic tool can follow job execution & progress monitoring. It is interfaced to Prefactis and permits content handling. It can manage restoration sub-systems like Brava, Diamant, M.I.R., Artifis, AudioCube, Dobbin, it permits restoration plan creation.

Defect analysis and description infrastructure: in order to correct defects, they have to be detected, a series of detectors for dust/dirt, grain/noise, blocking, visual activity, (frozen frame) were developed. The associated tools were a defect and quality summary viewer on a timeline, with synchronous play and navigation, standardised defect and quality information and description schemes, MPET-7 based.

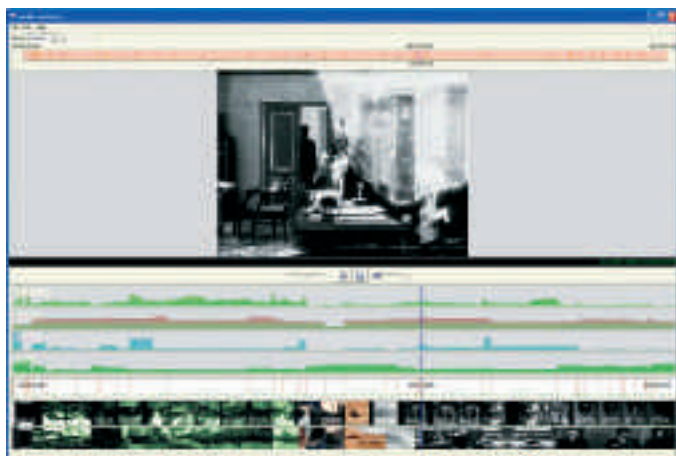


Fig 6. Interface for Defect and Quality control.

High-level restoration algorithms: within the audio restoration, specific developments were done concerning Cube-Tec products Audio-Cube and Dobbin. General tools for coordination of audio restoration and integration within the restoration workflow. A central editor form which the operator can start either manual or automatic restoration. Restoration algorithms plugged-in via VST interface.

Disk-to-disk real-time restoration tool: a disk to disk visual restoration environment integrating 3 restoration tools: Brava – Artifis and Scratchbox was developed, interfaced to RMT. Some of the characteristics are: smart navigation (go to next cut, click in timeline...), interactive restoration of dirty splices, blotch detection and removal, improved motion estimation.

For the DIAMANT V2.2 system new and improved tools were developed like: Re-timing, ReGrain, Pixelmotion, Image interpolator, DFlicker. Specifically for Video support: DInterlace, DropOut, Dshake, FieldSplit, restoration reports.

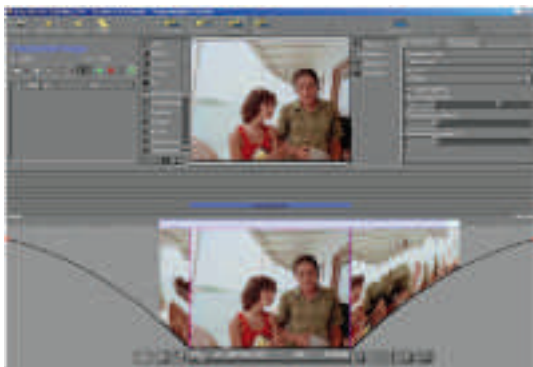


Fig 7. View of the DIAMANT system with integrated restoration algorithms.

Film restoration software tool: specific developments were done in the film domain in order to correct strong defects. In the audio domain: removal of wow/flutter, sprocket hum and noise. In the visual domain: motion estimation, blotch and dirt detection, large blotch removal, scratch removal, flicker removal, re-grain.

Storage and Archive Management

The storage and archive management work-area was indeed one of the most popular within the project. Working on a constant relation with users, it provided an important background for understanding and explaining the problems dealt within the project.

Among the main developments, can be found: a Web-Guide and Software tool for storage planning for audiovisual preser-

vation, Guide and Software tool for business-case planning for audiovisual preservation and organisation. Logistics and Quality Insurance System for Audiovisual Preservation.

The results of the studies, enquiries as well as the tools were made available through an online Audiovisual Archive Digitisation and Storage Guide, which gave all the necessary information an archive needs to know to understand and undertake preservation actions⁴. Tools for cost calculation or preservation planning could be found here so to estimate cost and effort for any audiovisual collections. A Wiki on preservation was also installed to answer the questions and give the theoretical approach to preservation⁵.

It also provided highly useful information about storage and storage evolution on the long-term, in order to orient and inform about the evolution of costs and storage.



Fig 8. Image of the Storage management page in the PrestoSpace website.

Metadata, Delivery and Access

It is essential within an archive process to have documentation and publishing tools. An environment was built within the project in order to permit the integration of existing documentation and the possibility to apply specific metadata extraction algorithms and to be able to hand improve the documentation.

In order to achieve these objectives, several tasks were realised, the first of them was to establish an XML document format schema in order to include existing metadata and to enlarge the extracted ones. A specific format based on P-Meta, MPET-7 profile nodes and ad-hoc structures was then conceived as a framework for documentation.

The specific platforms, one for documentation and one for publishing contents were constructed, integrated within a delivery environment called the Turnkey system.

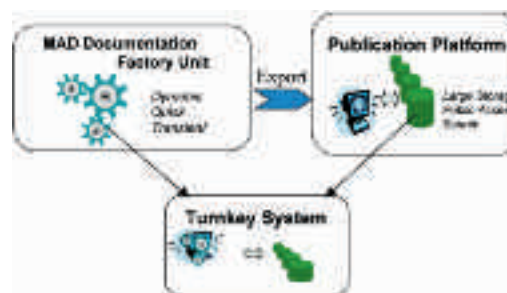


Fig 9. The structure of the documentation, publication and export system.

4. <http://prestospace-sam.ssl.co.uk/>

5. <http://wiki.prestospace.org/>

A series of specific GAMP's (Generic Activity MAD Processors) were developed by the rich panel of academic research institutions. These processors can be applied to document in order to extract information to enrich the documentation. These processes can be done in Italian or English. Among them we find: shots finder, video segmenter, speech to text, stripe images, semantic analysis, camera motion, text segmenter, web aligner.

A Competence Centre for audiovisual contents

The Competence Centre is one of the most important results of the project; it is conceived as tool to bring advice and guidance for Audiovisual actors as well as a technology integration point where the results of PrestoSpace as well as other projects can be made available to the community. Furthermore, it would provide a long-term integration point for future projects and remain as a continuous reference point for the audiovisual sector.

Initially the working concept for PrestoSpace was the "Preservation Factory" a unique place where all the actions were realised in the preservation chain. This concept is still applied within the project, however due to the diversity of actions needed, and the non-synchronisation of them, this becomes a task that has to be structured and organised through long periods of time. The preservation is done under factory conditions, where strong improvements were obtained with adequate organisation and monitoring of actions and quality. The Prefactis tool described earlier realises these actions and permits to transfer the preservation metadata to the other areas of work.

However the feedback obtained from users, concerns the necessity for precise orientation and expert analysis of problems in order to permit decision-making. The conclusion was that the best way to bring together all the results of the project was to bring them within an organisational instance that would provide a certain number of facilities to the actors of the domain. This implies:

- Bringing together the technological and methodological results of PrestoSpace in a centralised instance;
- Group in a centralised instance the actors of the domain: Archives, Service Providers, Industrials, Academics;
- Make expertises of audiovisual archives in order to orient them on preservation planning and eventually build a plan and monitor it;
- Establish links between Archives and Service Providers in order to find the most effective collaboration;
- Monitor their relationship;
- Include developments and technology of other projects, including PrestoPRIME;
- Become a European reference point for Audiovisual Preservation.

The Competence Centre was not built within the project, it was designed and it would be to the following project to launch it. The global ambitions were accepted by the European Commission, which sees in the Competence Centre a first attempt to structure activity, to be enlarged to other domains.

Living in the digital world: PrestoPRIME

A new project was launched in January 2009, under FP7, called PrestoPRIME⁶. This project brings together some of the for-

mer actors of PrestoSpace, with an overall objective of assuring the existence of digital data on a long-term perspective.

The purpose of PrestoPRIME is to research and develop practical solutions for the long-term preservation of digital media objects, programmes and collections, and to find ways to increase access by making media archives available within the framework of European on-line digital libraries. This will result in a range of tools and services made available through a networked Competence Centre. It is important to mention the European Digital Library Foundation as a partner, this Foundation, in charge of the Europeana Portal, brings new access possibilities to the domain.

The four principal objectives of the project

- To research and develop means of ensuring the permanence of digital audiovisual content in archives, libraries, museums and other collections.
- To research and develop means of ensuring the long-term future access to audiovisual content in dynamically changing contexts.
- To integrate, evaluate and demonstrate tools and processes for audiovisual digital permanence and access.
- To establish a European networked Competence Centre to gather the knowledge created by PrestoPRIME and use it to deliver advanced digital preservation advice and services in conjunction with the European Digital Library Foundation.

The partners

Institut National de l'Audiovisuel / British Broadcasting Corporation / Radiotelevisione Italiana / Joanneum Research Forschungs-gesellschaft mbH / Netherlands Institute for Sound and Vision - Beeld en Geluid / Oesterreichischer Rundfunk / Ex Libris / EURIX / Doremi Technologies / Technicolor / IT Innovation / University of Liverpool / Vrije Universiteit Amsterdam / Universitaet Innsbruck / European Digital Library Foundation

Total budget of the project: 12M€ Project starts on January 2009 and ends in June 2012.

Conclusion

The series of "Presto" projects have brought to Audiovisual archive community, an effective answer concerning the dangers and the roads that lead to the digital world. New answers are being searched today for long-term preservation of digital contents; it is not only a question of survival of data, it is also an important incentive for archives to get into the digital world and have the necessary assurance that their contents will not be in danger.

Important landmarks have been established, new technology is accessible, and an effective know-how is being transmitted to all archives. This is the result of the concerted actions of main actors of the audiovisual domain, with the indispensable funding and orientation brought by the European Community.

⁶. <http://prestoprime.org>

Preservation of Broadcast Archives – a BBC Perspective

by Richard Wright, Senior Research Engineer
BBC Research & Development, UK

This paper covers: 1) the basic preservation problems of audio-visual archives are reviewed, including data from the PrestoSpace and TAPE surveys; 2) an approach to preservation planning, stressing that preservation work needs to be informed by a general strategy for a collection or institution; 3) the work needed to build a business case in order to get funding; 4) the general principles of audiovisual preservation; 5) a detailed roadmap showing the preferred strategy and choices for migration from old formats, and finally 6) the new problems of digital preservation.

Broadcast content: who cares?

The tomb of John Keats in Rome has the inscription: "Here lies one whose name was writ in water". Broadcasting has a similar concern – our output, the whole result of all our effort – is writ 'on the ether'. There is nothing left of broadcasting unless it is recorded, collected and preserved; an operation that would be sterile unless there are also mechanisms for access to the preserved content.



Figure 1. Keats' Tomb. <http://www.flickr.com/photos/sgrunt/2077401671/> Creative Commons licence.

The problems of broadcast preservation begin with collection. Most European countries have a tradition of public service broadcasting, and part of that tradition is the existence of broadcast archives – either national institutions as with the French Institut National de l'Audiovisuel¹ and the Netherlands Institute for Sound and Vision² – or archives of individual broadcasters (for example RAI, ORF, SVT, RTE, NRK, BBC – and the regional broadcasters in Germany). In the UK the situation is complicated by an overlap of concerns, shared amongst the BBC, the British Film Institute³ (which is also the national archive for television content – except for the BBC, though the

BFI is the public access mechanism for BBC content, and has a mechanism for recording off-air) and the British Library Sound Archive (which provides public access to BBC radio content, and does selective off-air recordings of other radio broadcasting). To add complication, access to broadcast content in higher education is governed by the Educational Recording Agency⁴, and TV content (BBC and other channels) can be provided to higher education from off-air recordings made by the British University Film and Video Council⁵.

The UK situation is awkward, but at least there is a lot of recording and collecting. In the USA, where the major broadcasters are commercial, the broadcast archives are also commercial and provided limited public access (Jeff Ubois has documented the difficulties in his paper⁶ describing a search for TV material from the early 1980s). Odd exceptions have developed, allowing Vanderbilt University to record television news⁷ off-air, but otherwise TV is archived by the broadcasters themselves. Public broadcasting in the USA is similarly a dispersed activity, based on individual stations or even individual programmes. There is no comprehensive preservation programme.

That's the situation as seen politically. An engineer's view asks for the technical specification: what exactly is being collected? Here there are two basic answers: *studio quality* (meaning the highest quality available) material can be collected, or recordings in *broadcast quality* can be made off-air. The latter is the easy options, especially for a national body. But the former, archiving of studio quality content, is the *only* way to capture the full technical quality of the content. As with any archiving process, it is a matter of principle to always seek to 'capture the best'. Just as one would prefer an original manuscript to a photocopy, capture off-air is a poor second-best, to engineers and to archivists.

To show the difference, here are two photographs that differ by roughly the same factor as the difference between studio and broadcast quality. If only the second is archived, the detail and correct colours of the original are lost forever.



Figure 2. High quality image (left) and low-quality, as in off-air recording (right). © RW

1. www.ina.fr
2. <http://portal.beeldengeluid.nl/>
3. www.bfi.org.uk

4. www.era.org.uk
5. www.bufo.ac.uk
6. Ubois, Jeff, "Finding Murphy Brown: How Accessible are Historic Television Broadcasts?", *Journal of Digital Information*, Vol 7, No 2 (2006); <http://www.archival.tv/MurphyBrown-final.pdf>
7. Vanderbilt Television News Archive: <http://tvnews.vanderbilt.edu/>

Problems of audiovisual material

In 2004, the EC project PrestoSpace⁸ performed a survey⁹ covering 11 countries, with additional data from the public websites of audiovisual archives in another 9 countries. The 2004 survey covered the largest archives in each of these countries. The data was greatly extended by the survey in 2005 run by the EC project TAPE¹⁰, with responses from nearly 400 archives of all sizes.

How much audiovisual material is out there? The TAPE survey found about 25 million hours of film, video and audio in Europe. PrestoSpace had found 10 million hours, but there is an estimated five million hours in common between the two surveys – meaning a total of 30 million hours of audiovisual content held in formal collections. These figures support the general estimate of 50 million hours in Europe, and 200 million worldwide¹¹.

What condition is it in? According to TAPE, 70% of material is seen by its curators as in acceptable, good or very good condition, and 30% is deemed deteriorating or unknown. **But half the archives do not have controlled storage conditions, half have no regular equipment maintenance, and 2/3 do not have a systematic preservation programme.**

What is being done? Preservation projects were planned or underway to transfer about 250 000 items per year: about 1.5% of total holdings. At that rate it would take 60 years to deal with current holdings. Much of the material will not last for 60 years; average 'format life' of videotape is 20 years or less (as little as 10), and then the format becomes obsolete. Life expectancy of the material itself varies with storage conditions, but without cold, dry storage most audiovisual materials deteriorate after 20 to 30 years. Further:

- New material keeps coming in; project Presto found that acquisitions were exceeding preservation work by a four to one ratio¹².
- There is already insufficient budget and insufficient resources: the PrestoSpace survey found that archives had half the budget they needed (just for their planned 1.5% per year transfers), and the facilities providers also had half the needed capacity.

Preservation planning

The 30 million hours of audiovisual content just referred to largely sits on shelves, and it has a limited shelf life. Format obsolescence, media deterioration and damage mean that all the video and audio will need to be digitised and moved to some form of digital storage. The situation for film is different, as the format is not obsolete in the same sense as for audio and video. Film projectors and film itself can easily last for another century, and some forms of film, in proper storage, could last 400 years¹³.

8. <http://www.prestospace.org/>

9. Richard Wright, *Annual Report on Preservation Issues for European Audiovisual Collections*; http://digitalpreservation.ssl.co.uk/asset_arena/text/4/D22-4.pdf

10. Edwin Klijn and Yola de Lusenet, *Tracking the reel world*; <http://www.tape-online.net/survey.html>

11. Schüller, D, *Making Audiovisual Contents Available*, EuroChina 2002; www.eurochina2002.com/docs/Online%20after%2024%20May%2002/Conference_Presentations/Dietrich_Schuller.pdf

12. <http://presto.joanneum.ac.at/projects.asp#d2>

For all the audio and video (which was 95% of the 20 million hours in the TAPE survey), active steps will have to be taken or the material will be lost, within 20 to 30 years. This process has started, and indeed the new project PrestoPRIME¹⁴ has estimated that broadcasters have digitised something like five million hours of content already. However it is an expensive process, which requires planning – first in order to know what to do and the most economical way to do it, and second in order to build up the information – the business case – that is inevitably needed in order to raise funding.

PrestoSpace has published an online guide¹⁵ to audiovisual preservation, which gives more detail and more examples; this article will give a summary of the recommended planning process.

The PrestoSpace recommended process has these stages:

- *Cartography and triage*: make a map of your collections, and divide the overall task into parts, by priority.
- Develop a *collection strategy*: preservation is a strategic issue, and must fit the particular circumstances of a collection or institution. In the BBC, we are moving (gradually) from 1 million hours of content, on 100 km of shelves, to an all digital collection on various forms of digital storage. This change will be part of a major change in the ways of working across the archive, and across the whole BBC. We need to do the best we can to plan our preservation work in order to achieve an all-digital archive that best suits the future usage requirements of that archive – if we can predict them!



Figure 3. A bit of the BBC archive's 100 km of shelves – eventually all to be digitised. © BBC: photo used with permission.

- Within this collection planning a *preservation strategy* can then be developed. The preservation strategy is about much more than digitisation – because digitisation is one process and preservation has to be about all the processes needed to maintain content.
- Finally, for specific groups of material, a specific *preservation plan* will set out the actions, such as digitisation of one audiovisual format, that are identified for treating as a specific project. All the usual techniques of project management, from funding to sign-off, can then be used on individual actions in a preservation plan.

13. *Preserve then Show*, Danish Film Institute; www.dfi.dk/NR/rdonlyres/93B04DFF-ECCE-426B-8AA9-0CFD53707B3E/0/JesperStubJohnsen.pdf

14. www.prestoprime.eu

15. Richard Wright, *Preservation Guide*; <http://wiki.prestospace.org/>

A collection strategy should at least consider the following:

- The long-term purpose of the preservation work: where are you going with the collection?
- Access: audiovisual archives have traditionally had very limited access, for a range of reasons (technical, legal, logistical). Now, all but the legal constraints have virtually disappeared, and there is no technical barrier to universal instant access to all your holdings.
- Required changes to how the collection is managed: a digital collection doesn't have the same workflow and management processes as a shelf-based collection. Circulation control could disappear entirely. Acquisition of digital materials can be automated. Cataloguing may need to suit the needs of a much wider and less specialised set of users. In the BBC, we have the results of something like 2000 person-years of cataloguing effort in our TV and radio catalogue, designed to be used by librarians and professional 'film researchers'. We need a major change just to get this catalogue reshaped for public access – not to mention the effort needed to get the content itself online. Table 1 shows just one problem – our extensive use of specialist abbreviations.

Here is the BBC's preservation strategy for film:

Preservation Strategy: BBC 16mm film

Type of material	Condition	Action needed	Timescale	In-house or contracted?
16m mag sound track - masters	vinegar syndrome!	digitisation to file formats; destruction of originals	2 years starting immediately	Contracted; checking in-house
16m mag sound track - duplicates	vinegar syndrome!	destruction (after respective masters are transferred and checked)	2 years starting immediately	In house
16mm Ektachrome	some colour fade	Access copies made on digibeta and DVD	Starting when budget allows: in 2 years	Preparation and checking in-house; telecine contracted out
16mm B&W film negatives	good	Maintain in appropriate storage conditions; review condition at intervals	Review plan and condition every five years	Review is done in-house
16mm B&W film prints	fair: have been circulated	Maintain in appropriate storage conditions	Keep until preservation actions taken on negatives	Storage is in-house

Table 2: An example of preservation strategy.

The strategy is just a simple table. The mapping of the archive gave us the breakdown into the different kinds of 16mm film in our collection (and the numbers, not shown in the table) – and the triage into issues of preservation urgency and need for access allow the material to be prioritised in a simple red-amber-green fashion. I'm pleased to report that we've since dealt with the vinegar syndrome and have eliminated the problem (for magnetic sound tracks on acetate – we don't have

b/w	black and white
bldg	building
cpyrt	copyright
demo	demonstration
dep acty	dependent actuality
disco	discussion
doc	documentary
ex lib	ex library
ext	exterior
ftge	footage
fx	effects
gfx	graphics

Table 1: The first dozen items in one BBC list of cataloguing abbreviations.

- What the preservation projects should contribute to the collection strategy: a time when whole blocks of material are coming off the shelves is a time when other actions can be most convenient and economical. Examples are:

Installation of new shelving

A full inventory check

Repackaging

Photographing or scanning the packaging

Getting metadata off the packaging, or checking it for accuracy

any anymore!). We have finished the first three rows in the table, and hope to start pilot work this year on technology and a process for digitisation of the material in the fourth row: 16mm negatives.

A preservation plan is often very simple, once all the uncertainties around making a collection strategy and a preservation strategy have been resolved. Here is the BBC's preservation plan for the same collection of 16mm film:

Preservation Plan: BBC 16mm film

Type of material	Preservation Action	Service Provider	Batching	Outcome	Quality Control
16m mag sound track - masters	Digitisation at CD quality: 44.1 kHz sampling @ 16 bits; synch pulses recorded on 2nd CD channel	Three outside contractors selected by competitive tender	Monthly basis	One audio CD and one BWF file (on CD-ROM) per original mag sound track	Internal spot checking of each CD. Selective end-to-end checking. Done in-house.
16m mag sound track - duplicates	None				
16mm Ektachrome	Conservation for 2 more years; 10° C; 35% rh	In House			
16mm B&W film negatives	Conservation for 5 more years; 10° C; 40% rh	In House			
16mm B&W film prints	Conservation for 5 more years; 17° C; 35% rh	In House			

Table 3: An example of preservation plan.

This is a finite-duration plan. It refers to conserving the Ektachrome for two years – because we planned to concentrate on the urgent vinegar syndrome issue for the first two years. Then a new plan comes into effect, where we would list digitisation of the Ektachrome (and probably a review of the status of the B&W negatives).

With a plan, the column ‘preservation action’ contains entries that can be turned into costed business cases, and then into funded and hopefully very successful projects. The business case (or grant proposal, or funding request, or finance case) is often seen as difficult – but when the need is set within an overall strategy, and the work is focused on a specific action (one box in the above table), the problems should go away. The rationale is there, the action is specific, good cost estimates can be made – and the case goes through!

Preservation principles and processes

There is still the question of ‘what, exactly, should we do (with a particular part of a collection)?’ Again, specific decisions are easier if they are made within a framework. Regarding audio and video, the overall ‘what to do’ has one general answer; *digitise, and start now*. There are no analogue options for maintaining access to analogue audio and video (again, film has a different answer). So the practical question comes down to cost-effective digitisation.

In general, digitisation is most cost-effective with a *factory approach* – an efficient workflow, a sort of assembly line or

mass production. The efficiency doesn’t require every item to be the same – because they won’t be anyway. Some materials will have problems and others won’t. The efficiency is through *division of labour* for the staff doing the work. If one person gets material from the shelves, another deals with metadata, and an audio or video technical expert is allowed to concentrate on audio and video (and not shelves and metadata), there are well-known efficiencies to be realised.

If the collection or the staff are too small for division of labour, it may be that an outside service provider is the best option: a company with all the needed equipment and expertise, and a business that depends upon efficient workflow.

There are also principles about what to get out of digitisation. The ideal is uncompressed video or audio. For audio, this ideal is easy to achieve, and indeed all the IASA-TC04 expert recommendations¹⁶ are very clear that compressed audio is unacceptable for preservation. The minimum standard for audio is 16 bit quantisation at 48k samples per second. In the BBC we use the CD sampling rate of 44.1, but we see that as a small compromise made for practical reasons (to agree with what BBC radio uses in production). The material is stored as WAV files, and ideally as Broadcast Wave Files¹⁷. Everything else that a person would need to know about audio preservation and digitisation is in the IASA TC-04 document.

16. IASA-TC04, *Guidelines and the Production and Preservation of Digital Audio Objects*, 2nd Ed (2009)

17. http://en.wikipedia.org/wiki/Broadcast_Wave_Format

Ingest Format	Migration format	Notes
Low quality media		
VHS tape	DVD	Access Perfectly adequate for VHS playback
VHS tape	MPEG-4 files	Access Adequate for quality. Minimum data rates (MPEG-4): 500k b/s. There are MANY potential access formats, and they come and go.
VHS tape	DV files	Archive (temporary) 25 M b/s, 12 GB/hr. Migrate to lossless for preservation.
‘low end’ digital files	Save as is, AND save as DV or lossless	Archive (temporary) Before format or DV format becomes obsolete, migrate to lossless for preservation.
DVD	DV files	Archive (temporary) 25 M b/s, 12 GB/hr. Migrate to lossless for preservation.
Medium quality		
U-Matic	DVD	Access Reduces quality; suitable only for viewing.
U-Matic	DV files	Archive (temporary) 25 M b/s, 12 GB/hr. Migrate to lossless for preservation.
DV, DVCAM	DV files (meaning .avi files with native coding)	Archive (temporary) transfers to computer at 25 M b/s, resulting in an .avi file ‘clone’ of the original DV tape. Migrate to lossless for preservation.
High Quality		
BetaSP, Digibeta, other pro formats	Uncompressed	Archive Uncompressed standard definition video: 200 Mb/s. About 100 GB for one hour, meaning 25 DVD-ROMs (or part of one data tape or hard drive).
BetaSP, Digibeta, other pro formats	Motion JPEG 2000 (lossless version)	Archive lossless compression, with a resultant data rate of around 90M b/s. About 40 GB for one hour.
DVCPRO50	.avi files, DV coding	Archive (temporary) As for DV, but at twice the data rate. Less susceptible to loss on future migrations. Migrate to lossless for preservation.
‘High end’ digital files	Save as is	Archive (temporary) Before format becomes obsolete, migrate to lossless for preservation.

Table 4: Video Migration Roadmap.

For video, there are problems:

- uncompressed video requires about 150 times more storage space, per hour, than uncompressed audio. So an affordable option for audio becomes a difficult decision for video;
- the material coming into the archive may already be compressed, with no possibility of access to an uncompressed signal;
- there is no simple, standard video file format – no direct counterpart to the WAV files for audio.

Professional broadcast archives can use the MXF¹⁸ file format (a wrapper or container format). Other considerations include whether the archive's IT infrastructure prefers Apple or Microsoft file formats, and also what file formats are supported by any special equipment, such as video edit stations or software.

A final general principle is: if forced into use of a compressed format (by constraints at acquisition), do not move from one compressed format to another. The digital world has promised us perfect transfers – clones – every time we make a copy, without the *generation losses* inherent in an analogue transfer. But if we migrate from one lossy format to a different lossy format, there is an decoding and recoding process involved which can never increase quality, and is most likely to produce a drop in quality – a new, digital *generation loss*.

There is an argument for a partial exception, and that argument is inherent in the table 4 (p. 16). When going from low quality originals, one could move to a lossy compression format at a professional quality. One should never 'move sideways' from one compressed format to another of different encoding but similar datarate – that would be a generation loss. But one

could climb the stairway to the heaven of uncompressed video by taking one intermediate step, 'resting' at a high-quality lossy format before moving to uncompressed a decade later. Full explanation of the table is giving in the PrestoSpace¹⁹ wiki. The items marked "Archive (temporary)" are those which are moving to uncompressed video, but via one stage of use of a small amount of lossy compression.



Figure 4. Stairway to uncompressed heaven -

by always going higher (but never going sideways).

http://www.flickr.com/photos/m_e_l_o_d_y/1002586303/ Creative Commons licence.

Stayin' Alive: Digital repositories and digital storage

All the strategy and planning and financial estimation and project management and digitisation finally results in a substantial body of audiovisual content existing as files, on some sort of mass storage. This is a major achievement:

- the content has been rescued from obsolete, fragile and decaying carriers;
- the connection between content (a Caruso recording) and carrier (a 78 rpm shellac disc) has been broken – forever; files can sit on any kind of digital storage;
- the content has been freed from shelves, and made ready for straightforward conversion to low-resolution version suitable for Internet access.

One might be tempted to sit back and bask in the rewards of a job well done: audiovisual content now firmly in the digital world. The question is: how firm is the digital world.

Unfortunately, digital storage devices have their own obsolescence, and on a three to five year lifetime rather than the 20 (or more) year lifetime of most analogue formats. File formats have their own obsolescence as well, especially the compressed formats used for web access. Proprietary formats such as Real Audio become displaced by more open (though not completely open) formats such as Quicktime and MPEG. New developments such as YouTube shift people's preferences for viewing formats.

The result is that requirements for vigilance and management – for continuous maintenance of a collection – remain as necessary for digital content as for analogue. The managerial requirement is the same as ever, but there are new problems and new coping strategies in the brave new digital world.

As an example, the BBC transferred audio material from ¼" (6mm) tape to broadcast wave files, and stored those files on writeable DVDs (DVD-ROM). That format was chosen as an interim measure, as there was no general BBC-wide mass storage system at the time. A few years later, and this material was transferred to files on USB-connected terabyte hard drives (30 of them, holding 40 thousand hours of archive content). The good news: that migration had 1% of the cost of the original digitisation, because it was digital-to-digital and could be automated to a considerable extent. The bad news: these hard drives have had various problems, and a professional-level BBC-wide mass storage system does now exist, so the material is being migrated again. Also, at the same time as transfer from DVD-ROM to hard drive, a back-up copy was made on LTO-3 datatape. This format is about to be replaced by LTO-4, and by the time that LTO-5 comes on the market, the LTO-3 tapes will have to be migrated.

There are many such examples. The Austrian Mediatheque²⁰ is on its third datatape robot since the year 2000, as are the Swedish broadcaster SVT and the French national archive INA. Even robots struggle to survive in the digital world! Another case is material 'born digital' on formats such as DAT and mini-disc, where again the formats are obsolete and the content requires migration.



Figure 5. Stayin' Alive: robot survival in a digital world. Robot:

<http://www.flickr.com/photos/punkjr/518165822/> Creative Commons licence.

Fortunately there are sources of aid²¹. Many areas of modern life are creating digital content, from word processing and book scanning to scientific and business data. A whole technology has grown up, centred around digital repositories and digital preservation standards and technology. Most of this technology has been developed by the 'conventional' library world, as it moved to electronic documents. The key issue for audiovisual content is to find ways to use digital library tools and processes on audiovisual files. The new project PrestoPRIME is addressing that problem.

20. www.mediathek.ac.at/

21. A brief summary is Richard Wright, *Preservation of Digital Audiovisual Content* (2008); www.digitalpreservationeurope.eu/publications/briefs/audiovisual_v3.pdf

18. <http://en.wikipedia.org/wiki/MXF>

19. Migration Paths for Video Media: <http://wiki.prestospace.org/pmwiki.php?n=Main.Roadmap>

La stratégie de sauvegarde et de numérisation des archives de l'Institut National de l'Audiovisuel, 1999-2015

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1. Introduction

Au tournant du 20^e siècle, tous les centres d'archives audiovisuelles se sont trouvés confrontés aux mêmes questions touchant le devenir de leur patrimoine : fragilité des supports, changements des formats techniques, obsolescence des machines de lecture, volumétrie importante compte tenu de l'âge désormais respectable des chaînes de radio et de télévision publiques, etc. De plus, la numérisation des activités de diffusion et de production, la nécessité de pouvoir exploiter aisément un patrimoine né analogique, les perspectives d'accès ouvertes par le numérique et les réseaux ont précipité la recherche de solutions adéquates de préservation des contenus archivés, et la conception d'ambitieux plans de sauvegarde et de numérisation.

Chaque institution a apporté des réponses, souvent similaires sur le plan purement technique, mais très diversifiées dans leur mise en œuvre : il s'est agi en effet de tenir compte des missions propres à chaque institution (diffuseur, archive nationale), des cultures (gens de télévision et de radio, gens de cinéma), des priorités et objectifs stratégiques.

L'Ina, une institution singulière

L'Institut National de l'Audiovisuel ne fait pas exception. Son plan de sauvegarde et de numérisation, lancé en 1999, fait aujourd'hui figure de modèle, ne serait-ce que par l'ambition

qui lui a été donnée, quelques années plus tard, de traiter d'ici 2015 l'intégralité des fonds analogiques « menacés », soit un million d'heures de programmes de radio et de télévision. Cet objectif qui représente un effort continu sur dix-sept années est forcément lié à la stratégie mise en œuvre par l'Institut et à la spécificité de l'entreprise Ina.



1. Bâtiment de l'Ina. Photographie : Nicole Bouron Flacinet. © Ina

En effet, l'Ina, établissement public à caractère industriel et commercial, né en 1974 de l'éclatement de l'ORTF, occupe une place singulière dans le monde des archives, se positionnant à la fois dans le domaine des médias, comme le sont la BBC ou la RAI, et dans le domaine culturel, à l'instar des grandes institutions patri-

	Le fonds des archives « professionnelles »	Le fonds du dépôt légal de la radio et de la télévision
Origine des fonds	Chaînes publiques de radio et de télévision Radio : depuis les années 30 Télévision : depuis 1949 Actualités cinématographiques : 1940-1969 Fonds privés confiés à l'Ina pour exploitation	Chaînes publiques et privées de radio et de télévision Radio : depuis 1994 Télévision : depuis 1995 2009 : collecte par captation de 20 chaînes radio et 100 chaînes de télévision Fonds privés confiés à l'Ina à des fins de consultation scientifique
Volumétrie au 1 ^{er} janvier 2009	Radio : 721.000 heures Télévision : 785.000 heures	Radio : 1.400.000 heures Télévision : 971.000 heures
Régime juridique	Droits d'exploitation détenus par héritage légal (ORTF), puis par dévolution des diffuseurs publics Lois sur la communication audiovisuelle	Droits limités à la consultation à des fins scientifiques dans les emprises de l'Ina Loi sur le dépôt légal (1992)

2. Fonds conservés à l'Ina : archives « professionnelles » et fonds du dépôt légal.

moniales que sont la Bibliothèque du Congrès, la BNF ou les Archives nationales. Cette double appartenance trouve ses fondements dans la dualité même du système juridique qui encadre son activité : la loi sur la communication audiovisuelle, la loi sur le dépôt légal. Elle se retrouve dans la nature des fonds conservés : le fonds des archives « professionnelles », qui remonte aux origines de la radio et de la télévision et qui s'adresse aux professionnels ; le fonds du dépôt légal, plus récent et plus étendu, qui s'adresse aux étudiants et aux chercheurs (voir tableau p. 18). Ce sont les Archives « professionnelles » qui sont concernées par le Plan de Sauvegarde et de Numérisation (PSN).

Le PSN aujourd'hui

Dix ans après le lancement du PSN, les résultats sont là et les chiffres sont éloquentes : 360.000 heures de télévision et 180.000 heures de radio ont été sauvegardées et numérisées. 540.000 heures de programmes sont donc accessibles en ligne par les professionnels ; une large sélection de 22.000 heures correspondant à 100.000 documents est offerte en consultation au grand public.

Dix ans après le lancement du PSN, les procédures sont établies, de nouveaux outils ont été développés, le système est rodé, industrialisé ; de nouvelles versions des services d'accès sont sur le point d'être déployées. Ce qui apparaît aujourd'hui comme une évidence, pour les praticiens comme pour les usagers de l'archive, est le produit d'un cheminement de dix ans. Mais se souvient-on encore des commencements ?

J'ai eu le privilège d'être associée aux équipes chargées du lancement et de la mise en œuvre du Plan de sauvegarde et de numérisation. J'ai relu les notes, les études, les rapports qui documentent l'histoire de ce grand chantier. C'est par ce biais que je souhaiterais évoquer ici le PSN : dire les évidences, la constance de la volonté politique, mais aussi les difficultés, les interrogations, les évolutions ; montrer comment le chemin a été trouvé, comment les choix ont été infléchis ; partager cette expérience exceptionnelle avec ceux qui, comme l'Ina, ont déjà fait un grand bout du chemin, comme avec ceux qui, aujourd'hui encore, le cherchent.

Dans cette perspective, on rappellera d'abord le contexte dans lequel a été lancé le PSN ; puis on passera en revue les grandes questions qui se sont posées et les réponses qui ont été apportées. Enfin, sur la base de quelques exemples, on montrera comment l'Ina a organisé sur ce terrain une coopération fructueuse tant avec ses partenaires européens qu'avec ses partenaires plus lointains, en Afghanistan ou en Afrique.

2. Retour vers les commencements

Depuis toujours, la politique d'archivage de l'Ina a incorporé en tâche de fond des opérations de restauration et de transfert des programmes sur des supports « modernes », sinon pérennes. Mais le rythme de transfert, qui pourtant s'était accéléré en 1997 pour atteindre quelques milliers d'heures annuelles, s'est avéré très insuffisant pour faire face à la dégra-

dation des supports film et bandes magnétiques, à l'obsolescence des formats vidéo, aux volumes à sauver.

La situation devenait critique, générant des lenteurs dans l'exploitation, et un mécontentement des usagers qui attendaient de l'Ina un meilleur niveau de service. Le délai de traitement des commandes de production atteignait alors couramment trois semaines !

Premiers pas

Cependant, la révolution technologique en cours imposait un nouveau défi, le passage de l'analogique au numérique. Jusque-là, le numérique à l'Ina était principalement le territoire du service de la Recherche. Aux Archives, la maquette d'une banque de données numériques interrogeables à distance avait été montée dans le cadre des « autoroutes de l'information » ; en 1998, fut mise en service la première application numérique opérationnelle, baptisée AGPE, un système de numérisation des extraits vidéo, résultant des repérages effectués par les clients, et permettant de capitaliser ces extraits en vue de leur réutilisation.

L'Ina fait le choix du numérique

En 1999, l'Ina définissait une stratégie d'entreprise fondée sur le numérique. Pour les Archives, cette stratégie s'est traduite par le lancement conjugué du Plan de Sauvegarde et de Numérisation et du Plan Patrimoine.

Il n'est pas inutile de s'attarder quelques instants sur les objectifs de ce Plan Patrimoine qui a engagé la modernisation radicale des Archives. Il s'agissait d'adapter les archives aux nouvelles pratiques d'exploitation des images et des sons et aux changements technologiques induits par le numérique, en créant une collection numérique de grande amplitude, et en développant les outils permettant de gérer et d'exploiter cette collection.

Pour ce faire, plusieurs chantiers ont été ouverts, parmi lesquels :

- des chantiers techniques : mise en place d'une infrastructure de stockage de masse, développement d'un système de *workflow* permettant de fluidifier les transactions liées au traitement d'une commande ;
- des chantiers documentaires : normalisation du traitement documentaire, afin de faciliter les échanges de données, celles venant des diffuseurs et celles qui circulaient entre les différents secteurs de l'Ina travaillant sur les archives ; développement d'un système documentaire de nouvelle génération, permettant d'accéder en ligne aux documents numérisés et de structurer les fonds (segmentation des programmes, documentation des segments, création de dossiers thématiques), baptisé ultérieurement TOTEM ;
- des chantiers juridiques : négociation d'accords collectifs avec les différentes catégories d'ayants droit en vue de faciliter l'exploitation des archives sur les nouveaux réseaux ; numérisation des dossiers de production.

Le **Plan de sauvegarde et de numérisation** constituait la

pierre angulaire de ce plan Patrimoine. Tel que défini en 1999, le PSN avait pour but :

- de sauvegarder le patrimoine audiovisuel « en danger », évalué à 220.000 heures, en créant des copies de préservation ;
- d'offrir un accès élargi aux contenus en numérisant « une grande partie » des archives ;
- et ainsi, de permettre une exploitation des fonds à la fois plus efficace, pour offrir un meilleur niveau de service à nos partenaires institutionnels que sont les diffuseurs publics, et plus étendue, la numérisation des fonds devant permettre de développer sur une grande échelle la commercialisation des archives.

L'infrastructure technique du PSN

Les **choix des formats numériques** ont été effectués en fonction des technologies disponibles en 1999. Il s'est agi du Béta numérique pour la copie de préservation, des fichiers MPEG 2 à 8 Mb/s¹ pour l'exploitation, des fichiers MPEG1 à 1 Mb/s pour la consultation en ligne. On considère aujourd'hui de nouveaux formats, comme le H264 à environ 400 Kb/s² pour la consultation en ligne ; et des formats de fichiers pas ou peu compressés pour la copie de préservation (en remplacement de la Béta numérique), comme le MJPEG 2000 ou le H264 intra.

Les **chaînes de transfert** ont été conçues en fonction de la nature et de la qualité technique des supports et enregistrements d'origine. Ainsi pour le film d'actualité, les sujets d'une même journée font l'objet d'une remise en état mécanique, puis ils sont mis bout à bout pour passer au télécinéma, donnant naissance à une Béta numérique qui sera encodée en MPEG 1 et MPEG 2. Les cassettes ¾ pouce, supports des programmes de flux (parallèles antenne), sont nettoyées, et leur contenu est encodé directement en MPEG 1 et MPEG 2, à la différence des bandes vidéo 2 pouces, supports des programmes de stock (fictions, variétés), qui sont transférées sur un master de conservation Béta numérique avant encodage.

L'objectif de numérisation fixé par le premier Contrat d'objectifs et de moyens pour les années 2000 à 2003 a été établi à 123.000 heures de télévision (et 40.000 heures de radio). Il a été atteint grâce à la mise en œuvre de trois ensembles de systèmes techniques :

- Le premier dispositif, qui a pu démarrer dès 1999, est constitué des chaînes de traitement externes, gérées pour le compte de l'Ina par des prestataires.
- Le second dispositif, interne celui-là, appelé SNC (Sauvegarde, Numérisation, Communication), est dédié en priorité aux travaux de sauvegarde et de numérisation liés aux demandes des clients. Les chaînes SNC ont été opérationnelles en janvier 2001.
- Le troisième dispositif consiste à capter en numérique la programmation courante des chaînes. Il a été mis en œuvre par

l'Inathèque dans le cadre de sa mission de collecte des nouveaux programmes. Ce dispositif a fonctionné pour la télévision à partir de 2001.

Tels furent les commencements du Plan de Sauvegarde et de Numérisation.

3. Les grandes questions

L'on avait fait les choix stratégiques et techniques. L'infrastructure était en place. Les premiers résultats étaient tangibles. Mais ce n'est qu'après le lancement du PSN que l'on prit une pleine conscience des questions qu'il restait à instruire, et pas des moindres : la volumétrie, la sélection, le financement, etc.

Cette période de questionnement débute au moment même où Emmanuel Hoog est nommé à la présidence de l'Ina, en 2001. Son arrivée va permettre de consolider l'édifice encore fragile du PSN, de l'installer dans la durée, de lui donner une ambition nouvelle, et de construire, à partir d'un fonds numérisé de plus en plus conséquent, une galaxie de services d'accès à ce patrimoine.

Avec lui, l'Ina va s'engager dans la sauvegarde et la numérisation de « toute » la mémoire audiovisuelle archivée, et dans la communication de ce patrimoine. Pour réaliser cette nouvelle ambition, il a fallu instruire un certain nombre de questions essentielles que nous allons passer en revue.

La volumétrie

Une première évaluation des matériels de télévision et de radio à sauvegarder avait été réalisée en 1999.

- Pour la télévision, on avait décompté 220.000 heures de programmes, représentant 51% des fonds archivés : soit, 220 h film nitrate, 56.000 h film, 22.000 h de bandes vidéo 2 pouces, 12.000 h de bandes vidéo 1 pouce B, 130.000 h de cassettes Umatic.
- On notera que les bandes vidéo 1 pouce C et les cassettes Béta SP analogiques, n'étaient pas alors considérées comme matériels en danger. L'on est revenu depuis sur cette appréciation.
- Pour la radio, on avait décompté 305.000 heures de programmes, représentant 52% des fonds : soit, 20.000 h sur disques 78 tours à gravure directe, 280.000 h de bandes magnétiques, 5.000 h de cassettes DAT.

Face aux difficultés rencontrées au cours des premières années, et constatant le rythme d'avancement des travaux, il était clair qu'une partie importante du fonds serait sacrifiée si l'on n'accélérait pas le plan. En effet, au rythme d'alors, et considérant la durée de vie des supports archivés, l'Ina n'aurait pu sauvegarder que 37% du fonds télévision et 9% du fonds radio !

C'est avec le double objectif de sauvegarder « tout » le fonds et d'accélérer le PSN qu'un **audit du plan de sauvegarde** fut confié à la société Veritas. Il s'agissait d'évaluer les volumes de

1. Megabits par seconde.

2. Kilobits par seconde.

matériels archivés restant à sauvegarder, le rythme nécessaire pour tenir compte de la durée de vie des supports les plus fragiles, et les coûts afférents. L'Ina devait en effet s'appuyer sur une évaluation fiable pour évaluer les coûts et trouver les moyens financiers nécessaires à la mise en œuvre d'un plan intégral et accéléré.

Les résultats de l'étude furent communiqués en janvier 2003 :

- Les évaluations des matériels en danger furent relevées, pour atteindre respectivement 336.000 heures de programmes de télévision et 498.000 h de radio, soit un total de 835.000 heures (ramenées à 740.000 heures, si l'on tient compte des 95.000 heures sauvegardées au cours des années 1999 à 2002).
- L'échéance de fin du PSN est fixée à 2015.
- Le coût total du PSN est évalué pour les années 1999 à 2015 à 193 millions d'euros.

Pour atteindre ces nouveaux objectifs, l'audit a formulé un certain nombre de recommandations visant notamment à :

- Renforcer les équipes Ina en charge de la gestion du PSN et à les doter d'un outil informatique de suivi des opérations. Aujourd'hui, soixante-dix collaborateurs Ina sont affectés à la mise en œuvre du PSN. Ils travaillent en liaison avec trente prestataires, mobilisant cent cinquante personnes affectées à des tâches de transfert technique et d'inventaires.
- Organiser la programmation systématique du PSN, en affichant des objectifs précis et argumentés de sauvegarde et de numérisation, année après année.
- Développer des méthodes de travail industrielles (chaînes de transfert « parallélisées »).
- Concevoir un système de stockage de masse adapté à la volumétrie. Aujourd'hui, les Archives disposent d'un système de stockage de masse évolutif, permettant d'accueillir la totalité des programmes numérisés, radio et télévision - sur disque dur pour un accès en ligne et sur des bandes LTO3 gérées dans une librairie robotisée ADIC.



3. Librairie robotisée ADIC. Photographie : Nicole Bouron Flacinet. © Ina



4. Robot serveur des fichiers numériques ADIC. Photographie : Nicole Bouron Flacinet. © Ina

Tout sauvegarder ?

La première réponse à la question incontournable de la sélection a été technique. On a commencé par sauvegarder les matériels les plus vulnérables : les films nitrates des années 40 et 50, les parties identifiées du fonds film atteintes du syndrome du vinaigre, les programmes enregistrés sur un support unique (film ou vidéo), les formats vidéo obsolètes (bandes 2 pouces). En parallèle, on a donné la priorité aux collections les plus demandées : les journaux, les magazines d'information, les émissions de variétés.



5. Rayonnage de films. Photographie : Michel Lioret. © Ina

Au-delà de ces choix évidents, des questions plus ardues se sont posées :

- Comment aborder la masse des émissions archivées sur plusieurs matériels (que ce soit du fait des techniques de production, ou parce qu'une copie d'exploitation avait été réalisée) ? Quel matériel choisir ? Comment identifier les doublons ?
- Comment arbitrer des choix de contenu ? Quels critères privilégier : l'intérêt culturel, historique, commercial, scientifique ?
- Comment gérer l'écart colossal entre les volumes en jeu, la capacité limitée de traitement dans le temps, les ressources financières disponibles ?

Il fallait échelonner les travaux. Il devenait urgent de définir une méthode permettant de décider quelle émission, sur quel support, envoyer en sauvegarde, et à quel moment. Et pour établir la méthode sur des bases fiables, il était tout aussi impératif d'améliorer la connaissance que nous avions de nos fonds, tant sur le plan des contenus que sur le plan technique.

Un projet **Connaissance des fonds** avait été lancé en 2001 pour accompagner la fusion des équipes travaillant sur les fonds de l'actualité et de la production télévisés. Ce projet a permis de donner une vue d'ensemble des collections archivées, sous l'angle de l'histoire des programmes, une vue plus qualitative que la vue très analytique fournie par les bases de données documentaires. Ce travail, qui a mobilisé de nombreux collaborateurs des archives, chacun détenant un savoir précieux sur telle ou telle partie du fonds, a débouché sur des stages de sensibilisation des personnels et sur l'édition de dossiers décrivant les grandes catégories de programmes (le journal télévisé, les fictions, les variétés, les documentaires, les sports), un fonds particulier (la presse filmée), ou une problématique essentielle pour la compréhension des archives (l'évolution du traitement documentaire, l'histoire des supports, la gestion des droits).

C'est la même année, à partir du mois de juin, que des campagnes systématiques ont été lancées pour évaluer le degré d'atteinte du fonds par le « syndrome du vinaigre ». Nous savions qu'une partie du fonds film et des bandes radio était « vinaigrée », mais nous n'en avons pas la cartographie : quelles collections étaient touchées, sur quelles années, quel était le niveau et le rythme de dégradation, où fallait-il intervenir immédiatement ?

Pour nous accompagner dans la définition des priorités, un **Comité de sauvegarde**, présidé par Jean-Noël Jeanneney, composé d'une douzaine de personnalités extérieures, représentant la communauté des créateurs et utilisateurs d'archives, a été mis en place. Il a été chargé de définir avec les responsables Ina du PSN les parties du fonds à « sauvegarder en priorité ». On notera que le terme de sélection avait été banni ! Cinq séances, programmées de mars 2001 à juin 2002, ont été consacrées respectivement aux émissions d'information, aux magazines et documentaires, aux fictions, aux émissions musicales, au fonds « parlé » radiophonique. Elles ont contribué de manière significative à l'enrichissement et à la clarification des problématiques de sauvegarde.

Tous ces travaux, relatifs à la volumétrie et à la sélection, ont débouché fin 2003 sur une redéfinition du plan de sauvegarde, conformément aux préconisations de l'audit Veritas, et sur l'élaboration d'une grille de programmation complète et sophistiquée de réalisation du plan « accéléré », prenant en compte l'ensemble des paramètres - techniques, catégories de programmes, collections, volumes horaires, coût, échelonnement dans le temps - pour dire précisément dans quel ordre et suivant quelles logiques traiter les collections, et ce jusqu'en 2015.

Financer un PSN accéléré

Le coût des opérations de sauvegarde et de numérisation reste élevé même si la mise en place de chaînes industrielles et le caractère massif du plan ont permis de réduire très sensiblement les coûts unitaires des prestations, par rapport aux prix usuels pratiqués sur le marché. A cet égard, il convient de noter que le traitement du film est infiniment plus onéreux que celui de la vidéo. La sauvegarde d'une heure de film coûte de 6 à 10 fois plus cher que celle d'une heure de vidéo. La chaîne de traitement film inclut en effet des opérations de remise en état mécanique de la pellicule, de montage, d'étalonnage, qui sont autant d'opérations manuelles minutieuses et longues.

Le coût total du PSN accéléré était évalué à 193 M € : comment a-t-il été financé ?

La sauvegarde des matériels réalisée au cours des années 1999 à 2003 avait été intégralement financée par l'Ina sur ses fonds propres (37 M €), dans le cadre d'un premier contrat d'objectifs et de moyens. Par ce contrat, l'Etat garantissait à l'Ina sur les années 2000 à 2003 un niveau de ressources lui permettant d'atteindre un certain nombre d'objectifs définis ensemble. Concernant le PSN, l'Ina s'engageait au terme du contrat, en 2003, à avoir sauvegardé et numérisé un volume de 126.000 heures de télévision et de 40.000 heures de radio.

Dès lors qu'il s'est agi de passer à la vitesse supérieure, l'Ina a dû convaincre les pouvoirs publics, les parlementaires, les professionnels et l'opinion du bien fondé d'un plan de sauvegarde et de numérisation « intégral et accéléré ».

On a évoqué plus haut le Comité de sauvegarde qui a su exprimer avec éloquence la valeur patrimoniale, artistique, professionnelle, commerciale, scientifique des archives, et l'impossibilité de sélectionner, car cela voudrait dire que l'on serait prêt à abandonner des pans entiers du patrimoine. On a évoqué aussi le rôle clé joué par les résultats de l'audit Veritas qui a su chiffrer l'ambition du projet.

Dans un registre plus politique, il faut mentionner l'article du président Emmanuel Hoog « Tout garder : les dilemmes de la mémoire à l'âge médiatique » publié dans la revue *Le Débat* de mai 2003. C'est une réflexion sur le thème de la mémoire et de la responsabilité éminemment politique de la sélection. C'est aussi un vif plaidoyer en faveur d'un plan de sauvegarde qui engloberait tout le patrimoine confié à l'Ina.

Il faut aussi rappeler le colloque organisé le 1^{er} avril 2003 par l'Ina à l'Assemblée nationale : « Les archives de la radio et de la télévision : un nouveau patrimoine à sauvegarder ». Ce fut l'occasion d'expliquer publiquement les menaces qui pèsent sur les archives audiovisuelles, de souligner les enjeux attachés à la préservation du patrimoine audiovisuel, de répondre par anticipation aux questions que soulève la mise en œuvre d'un plan accéléré, de montrer que la BBC et la RAI avaient entrepris des projets de même ampleur.

Tous ces efforts portèrent leurs fruits. En novembre 2005, M. Renaud Donnedieu de Vabres, ministre de la Culture et de la Communication, et M. Jean-François Coppé, ministre délégué au Budget, signaient avec l'Ina un nouveau Contrat d'objectifs et de moyens, le COM 2, couvrant la période 2005 à 2009.

Les ambitions portées par l'Ina et la constance de ses efforts pour la sauvegarde du patrimoine audiovisuel national étaient désormais reconnues et validées. La consolidation de la dotation de redevance ouverte en 2005 et les compléments prévus les années suivantes impulseront, dès 2006, une nouvelle accélération du PSN pour le porter à un niveau qui permettra **la sauvegarde intégrale des collections menacées à l'horizon de 2015**, conformément au scénario de sauvegarde fondé sur les conclusions du rapport Veritas.

Mars 2009, nous arrivons bientôt au terme du COM 2. Les engagements ont été tenus, plus de la moitié des fonds menacés est désormais préservée ce qui devrait permettre à la France d'être le premier pays à pouvoir sauver son patrimoine radio-phonique et télévisuel. Le COM 3, actuellement en gestation, devrait prendre en compte la suite du PSN et la sauvegarde du fonds Béta analogique, laissé de côté lors de l'étude Veritas. C'est un fonds qui vieillit mal et que l'on doit considérer aujourd'hui comme menacé.

Les nouveaux usages du numérique

Il va sans dire que le plan de sauvegarde et de numérisation de l'Ina n'a de sens que s'il débouche sur un élargissement de l'accès au patrimoine de la radio et de la télévision. C'est d'ailleurs une autre des orientations fondamentales inscrites dans le COM 2 : rendre accessibles à tous les publics, y compris au grand public, les collections audiovisuelles gérées par l'Ina.

La diversité des publics et des attentes a été prise en compte.

Le service **Inamediapro.com**, lancé en 2004, s'adresse aux professionnels des médias, français et étrangers. Il donne accès à l'ensemble des archives numérisées. Dès lors qu'il est accrédité, l'utilisateur peut conduire lui-même sa recherche (recherche multicritères dans une base de données, recherche guidée dans une arborescence thématique), consulter en ligne les vidéos, poser des repères et des commentaires, constituer un panier, et l'envoyer au service commercial pour analyse des droits, devis et recopie.

Dès 2005, le chantier pour la constitution d'une **offre accessible au grand public** « Archives pour tous » était lancé. En avril 2006, le service était ouvert sur le site Internet de l'Ina, avec un succès retentissant, qui ne s'est pas démenti depuis. Le service « Archives pour tous » donne accès à quelques 100.000 documents à travers une interface « éditorialisée », renouvelée chaque jour, organisée en rubrique, à l'image d'une chaîne Web. Il enregistre 1.000.000 de visiteurs uniques chaque mois.

Il faudrait aussi mentionner les produits élaborés **notamment**

pour le secteur éducatif, comme les « Jalons pour l'histoire du temps présent » qui proposent des collections plus restreintes, accessibles en ligne, sur des thèmes en rapport avec les programmes scolaires, un appareil pédagogique très poussé : fresques, accès chronologiques et thématiques, transcriptions, analyses contextuelles.

Ces services s'appuient sur le travail conjugué des documentalistes des Archives et des rédacteurs du secteur de l'Édition, œuvrant chacun avec des outils dédiés à ce que nous appelons la « thématisation », la valorisation et « l'éditorialisation » des fonds. Il s'agit non seulement de documenter les programmes, mais aussi de les fragmenter, de les organiser par thème, par personnalité, de les rééditer pour diffusion sur de nouveaux vecteurs (téléphones mobiles), de mettre en perspective des archives avec l'actualité du jour.

La préservation durable des archives numériques

Le débat sur la préservation pérenne des archives audiovisuelles ne s'est pas clos avec le numérique. Les supports des fichiers numériques – qu'il s'agisse de disques (DVD) ou des bandes informatiques (DTF, LTO) – sont tout aussi vulnérables et mortels que les supports des enregistrements analogiques.

On a quasiment abandonné la recherche d'un format pérenne, immuable, stable. Seuls les archivistes du film considèrent encore aujourd'hui que la pellicule est, dans l'état actuel des solutions numériques disponibles, le support le plus fiable et le plus économique pour la préservation à long terme des films 35 mm. Pour une conservation à moyen terme, ce qui est le cas à l'Ina des éléments film en attente de traitement, des mesures de **préservation préventive** sont prises pour le stockage (température de 10 à 12° ; humidité relative de 30 à 35%).

Le débat s'est déplacé sur un autre terrain. La solution pour assurer la préservation durable des archives numériques, c'est d'organiser la **migration** périodique des fichiers numériques sur de nouveaux supports. En effet la meilleure façon de conserver les enregistrements numériques, c'est de les recopier, à intervalle de quelques années.

C'est ainsi qu'en 2007, 150.000 heures de programmes numérisés et inscrits sur des bandes DTF2 ont été transférées sur des bandes LTO3. Alors que le passage de l'analogique au numérique avait pris plusieurs années en mobilisant d'importantes ressources humaines et financières, la recopie de numérique à numérique s'est faite en cinq mois et a été intégralement automatisée. La migration a aussi été l'occasion de faire le choix d'un support informatique « ouvert », c'est-à-dire préconisé simultanément par plusieurs constructeurs et largement implanté sur le marché, offrant de ce fait des garanties d'exploitation durables.

4. La sauvegarde du patrimoine audiovisuel mondial, une responsabilité partagée

La **coopération internationale** entre les grands centres d'archives de télévision s'est organisée dès 1977 lorsque fut créée la Fédération Internationale des Archives de Télévision (FIAT), une initiative conjointe de la BBC, de la RAI, de l'ARD et de l'Ina. La question de la sauvegarde des archives a toujours été au centre des discussions, et lorsqu'il s'est agi de la numérisation massive du patrimoine sonore et audiovisuel accumulé depuis les origines de la radio et de la télévision, les archives européennes, très présentes dans la FIAT, ont mis en commun leur expérience, notamment dans le cadre du projet PrestoSpace, un projet financé par la Commission européenne (voir l'article de Daniel Teruggi dans ce numéro d'*IPN*).

Au début de la décennie, et sous l'impulsion d'Emmanuel Hoog, élu en 2002 à la présidence de la FIAT, de nombreuses archives du Sud ont rejoint la Fédération. La coopération concernerait désormais aussi les archives les plus défavorisées. L'on a en effet considéré que la sauvegarde du patrimoine audiovisuel mondial était une **responsabilité collective**, partagée par la communauté des archives, et par les Etats, soucieux de protéger l'identité des peuples et la diversité culturelle. Il faut dire que la fragilité naturelle des supports, les conditions climatiques, les guerres, le manque d'intérêt et de moyens font que ces archives sont infiniment vulnérables.

C'est dans cet esprit que plusieurs initiatives ont été prises pour alerter l'opinion et les pouvoirs publics sur la nécessité et l'urgence de sauver les archives audiovisuelles :

- En octobre 2004, la FIAT lançait un appel mondial pour la préservation des archives audiovisuelles. L'appel, qui a été repris par les autres organisations professionnelles internationales qui s'intéressent aux archives audiovisuelles, a recueilli le soutien de plus de 10.000 signataires dans 110 pays³.
- En 2005, l'UNESCO décidait de la création d'une journée mondiale du patrimoine audiovisuel, célébrée chaque 27 octobre depuis 2006. Cette initiative a bénéficié du soutien des mêmes organisations professionnelles et des représentants d'une quinzaine de pays membres de l'UNESCO dont l'Autriche et la France.
- En 2007, Emmanuel Hoog lançait avec la FIAT le projet Archives en péril, un site Web conçu pour illustrer, images et vidéo à l'appui, la riche diversité des archives dans le monde et pour sensibiliser l'opinion.

Dans le même temps, l'Ina montrait l'exemple et engageait plusieurs projets pilotes de coopération, avec l'Afghanistan, le Cambodge, Madagascar, Timor Leste. On évoquera ici le plus abouti de ces projets, celui qui a pour cadre **l'Afghanistan**.

En juillet 2002, avec le soutien des autorités afghanes et en partenariat avec le Ministère des affaires étrangères, l'Ina a ini-

tié un vaste programme de sauvegarde et de numérisation des archives audiovisuelles en Afghanistan. Trois accords étaient signés avec Afghan films, la Radio Télévision Afghane (RTA), et une société de production indépendante qui détient les archives du Commandant Massoud, Ariana Films.

« L'objectif, écrit Emmanuel Hoog, était de créer les conditions permettant aux professionnels afghans d'assurer eux-mêmes, en toute autonomie, la conservation, la numérisation, puis la diffusion de leurs archives. Depuis sept ans, plusieurs milliers d'heures ont été numérisées et sauvées de l'oubli. Il reste encore à faire connaître ces documents numérisés, que de nombreux afghans n'ont jamais vus. Parce qu'ils ont été les acteurs de ces images, et qu'ils en sont aujourd'hui les uniques détenteurs, ils doivent pouvoir, dès demain, en être les spectateurs. Plus qu'une évidence, c'est une exigence que d'accompagner le peuple afghan à préserver et transmettre la richesse de ce témoignage sur son passé : c'est non seulement contribuer à la constitution de son histoire et de son identité, mais c'est aussi et surtout lui permettre d'écrire son avenir. »

Deux missions de dix jours chacune, par an, à Kaboul, depuis juillet 2002 ont permis de procéder à l'expertise des fonds, d'apporter des équipements – lecteurs-enregistreurs vidéo, télécinéma, ordinateurs –, d'installer des chaînes de transfert et de numérisation, de former les techniciens à la maintenance et à l'exploitation des équipements, ainsi qu'à la gestion documentaire des enregistrements.

Les résultats

Radio Télévision Afghane

- Télévision : 25% des 15.000 heures à sauvegarder sont numérisés
- Radio : 25% des 30.000 heures à sauvegarder sont numérisés

Afghan Films

- 50% des 500 heures de film sont numérisés

Ariana Films

- 50% des 1.200 heures de film sont numérisés et disponibles grâce à un accord commercial sur inamediapro.com

Un plan pour sauver les archives africaines

Aujourd'hui, les situations d'urgence sont d'abord en Afrique. C'est là que les archives sont les plus vulnérables, c'est là que la mobilisation des pouvoirs publics nationaux est la plus modeste, c'est là que les ressources sont notoirement insuffisantes.

On estime à 150.000 heures de télévision et 200.000 heures de radio les archives à sauvegarder dans les pays d'Afrique noire francophone, alors que le rythme actuel de sauvegarde n'est au mieux que de quelques milliers d'heures par an.

Et pourtant les archives de ces pays bénéficient depuis 2004 du soutien de l'Organisation internationale de la francophonie (OIF), du Conseil international des radios et des télévisions de l'espace francophone (CIRTEF), et de la FIAT : participation

3. http://www.ccaaa.org/paper_worldcall.shtml

régulière des responsables d'archives africains aux conférences de la FIAT ainsi qu'aux sessions de formation du CIRTEF (SEFOR), déploiement dans dix-sept pays d'un système de numérisation, documentation et de stockage des archives (AIME), donation de magnétoscopes ¾ pouce pour sauvegarder les cassettes Umatic qui constituent l'essentiel des fonds d'archives analogiques, etc.

Ces pays bénéficient en outre du soutien du ministère français des Affaires étrangères, à travers son Plan Images Archives. L'Ina, pour sa part, a initié un projet de coopération avec les archives malgaches et noué de nombreux accords avec les organismes de radio et de télévision africains pour l'organisation d'actions de formation.

Au total, il existe un grand nombre d'initiatives qui gagneraient à être mieux coordonnées. L'Ina espère pouvoir jouer un rôle décisif dans les années qui viennent afin de mobiliser les partenaires concernés, trouver les bonnes synergies, rassembler les ressources, et lancer, avant que la mémoire de l'Afrique ne se soit désintégrée faute de soins, un schéma directeur de sauvegarde et de numérisation du patrimoine audiovisuel africain.

Il s'agira de migrer les archives analogiques dans un format numérique, d'assurer la pérennité des enregistrements, de les rendre accessibles, de faciliter les échanges de programmes, et de créer les conditions de leur mise en valeur pour des usages professionnels, éducatifs, culturels et commerciaux.

5. Conclusion

Il existe un **cercle vertueux** qui unit la numérisation, l'accès, la sauvegarde : plus le volume des documents numérisés s'accroît, plus on peut diversifier les services d'accès, montrer les archives, générer de nouveaux usages, attirer de nouveaux utilisateurs, être « visible », intéresser les pouvoirs publics, trouver

des ressources pour développer plus avant la sauvegarde et la numérisation. Il faut commencer le travail de numérisation sans attendre d'avoir réuni tous les moyens nécessaires à la réalisation d'un PSN « idéal », il faut montrer les trésors que recèlent les archives ; c'est un moteur efficace pour mobiliser, convaincre, avancer.

Le numérique modifie le **statut de l'archive** : le concept « d'original », inscrit dans la culture de l'archiviste des années analogiques, n'est plus aussi fondamental. Les copies numériques ne coûtent pas cher à réaliser ; elles n'ont plus pour effet de produire une image dégradée. L'authenticité du document original demeure, mais le numérique offre des outils de segmentation et de réagencement des contenus qui permettent de servir tous les usages. Le numérique confère à l'archive de nouvelles qualités : l'accessibilité, l'ubiquité, le partage. Il ouvre aussi de nouveaux questionnements : la protection des droits de propriété intellectuelle et la lutte contre le piratage ; la mise au point de nouveaux outils pour l'indexation et la recherche.

Enfin, et de notre point de vue d'archiviste ce n'est pas le moindre, le numérique a profondément modifié les **métiers de l'archive**. En particulier les documentalistes ont vu leurs pratiques changer. Les tâches traditionnelles que sont le catalogage, l'indexation, la recherche documentaire sont désormais largement réalisées par d'autres intervenants – le producteur en amont qui livrera l'archive avec ses données de description, l'utilisateur qui peut accéder en ligne aux bases de données et à la consultation des vidéos. Ces tâches se sont estompées pour laisser place à d'autres, centrées sur l'organisation du fonds, la valorisation des contenus. Des outils nouveaux, on l'a vu, facilitent cette mission, et créent les conditions d'une connaissance fine, enfin maîtrisée des fonds, qui fait du documentaliste de l'ère « numérique » un spécialiste des contenus, un passeur. Dans ce monde numérique qui déborde d'images, ce rôle d'intermédiation est devenu essentiel.

Institut National de l'Audiovisuel de Francia. Resguardo de archivos y estrategia de digitalización (1999-2015)

Con el cambio del siglo XX, todas las instituciones que se ocupan de la memoria audiovisual enfrentaron los mismos problemas respecto del futuro de su patrimonio: fragilidad de los soportes, cambios de los formatos técnicos, obsolescencia de los equipos de lectura, volumen importante al considerar la edad respetable de las estaciones de radio y los canales de televisión públicos, etc. Además, la digitalización de las actividades de transmisión y producción, la necesidad de poder manejar fácilmente un patrimonio que nació analógico, las perspectivas de acceso que abren la tecnología y las redes digitales, aceleraron la investigación de soluciones idóneas para la conservación de los contenidos archivados y la concepción de ambiciosos planes de resguardo y digitalización.

El Institut National de l'Audiovisuel de Francia no es la excepción. Lanzó su plan de resguardo y digitalización en 1999, con el propósito de tratar antes de 2015 el patrimonio analógico "amenazado" en su totalidad, es decir, un millón de horas de programas de radio y televisión. Diez años más tarde, se pueden ver los resultados y las cifras son elocuentes: se preservaron y digitalizaron 360.000 horas de televisión y 180.000 horas de radio. Por lo tanto, los profesionales pueden consultar en línea 540.000 horas de programas y una amplia selección de 22.000 horas que corresponden a 100.000 documentos se encuentran al acceso del público en general.

Preserving Digital Public Television: Is There Life After Broadcasting?

by Nan Rubin,

Project Director, *Preserving Digital Public Television*, NDIIPP of the Library of Congress, USA

Television production has shifted rapidly from an analog process to one where virtually all programs are created and finalized as digital files. Such productions in public television are at great risk of being lost, because practices for long-term preservation of digital video are just now emerging, and because there is no mandate for preservation within the U.S. public broadcasting system. The National Digital Information and Infrastructure Preservation Program (NDIIPP) of the Library of Congress funded ***Preserving Digital Public Television***, a partnership between WNET-TV in New York, WGBH-TV in Boston, the Public Broadcasting Service, and New York University, to build a model preservation repository for digital video files and to examine broader issues related to operating such a repository. In addition to designing the repository itself, the project became a lead advocate for adopting technical and metadata standards across the television field and is pioneering preservation-compliant digital production workflows. The project also successfully advanced the position that the U.S. public television system recognizes the necessity of preservation to keep digital productions alive. This led to national funding being allocated for the first time to create a pilot initiative with a long-term goal of properly managing the collective archival holdings of public broadcasting in the U.S.

From Analog to Digital: The Transformation of Television Production

Public Television is responsible for the production, broadcast and dissemination of programs which form the richest audiovisual source of cultural history in the United States.

(Librarian of Congress, 1997)

In the very first set of reports commissioned by the National Digital Information Infrastructure Preservation Program (NDIIPP), the Library of Congress identified the challenges of preserving digital television productions:

By nature and necessity, public broadcasting is a hodgepodge of media types and formats... In whatever manifestations these objects previously existed, they become bits and bytes before they reach the public eye. That is an enormous amount of digital information to manage over time. As we move into the increasingly complex digital world, those charged with preserving our television heritage have the opportunity to develop and establish better coordinated and standardized preservation policies and practices to ensure what television programs and related assets survive.

(Ide, MacCarn, Shepard, & Weisse, 2002)

When this was written, it was not yet evident that television broadcast operations would be altered so profoundly or so rapidly by digital production and distribution technologies. In less than a decade, broadcast television has shifted largely from a manual process based on videotape, to one that is almost entirely file-based. Virtually all programs are now shot and edited digitally, and completed programs are finalized as digital files. Television distribution and transmission have been equally transformed, as tape-based submissions to the Public Broadcasting Service (PBS) and other national program services in the U.S. are being replaced by digital file transfers, and nearly all local broadcast playback is now tapeless, with programs stored, assembled and aired as files directly from a server.

The viewer experience has shifted as well. The explosion of on-line broadcast content, coupled with a constantly changing array of viewing devices, have created a fundamentally altered video environment which requires programming to be viewable on everything from the very smallest iPod screen to giant wall-size flat panels. By summer 2009, all U.S. full-power television stations will have turned off their analog transmitters and be broadcasting exclusively on digital channels. The all-digital television chain will be complete, from program producer at the start of production to the mobile viewer at the end of the line.

What do these changes mean for television archives? In a culture that expects broadcast media to be available whenever it chooses, the notion of a video archive takes on new meaning: not as a gatekeeper to accessing older content, but rather as a guardian protecting that content and keeping it vital.

Unlike videotape, it isn't enough to close a digital file and put it on a virtual shelf. Leaving archiving to the end of the production process opens the door to a host of threats including disassociation, migration problems and obsolescence. For video in particular, acceptable practices to save and access very large files, manage ever-changing file formats, and maintain rich metadata are just now emerging. By using digital asset management systems and related tools, there is a great opportunity to create value and revenue from assets. However, it requires adopting a new approach that incorporates preservation practices into the entire digital production chain.

Bringing Digital Preservation to Public Television

The non-profit Corporation for Public Broadcasting (CPB) was created by the U.S. Congress through the Public Broadcasting Act of 1967, specifically to dispense Congressional funding to America's public broadcasters, now numbering more than 350 television stations and over 600 radio broadcasters. Annual funding to CPB provides direct grants to stations and supports system-wide needs including program funds, copyright royalty fees, and national program distribution.

Although the Act authorized CPB "to establish and maintain, or contribute to, a library and archives of noncommercial educational and cultural radio and television programs and related materials," CPB never allocated any funds to support this charge. Consequently, no mandate for system-wide preservation exists at any major U.S. public television institution.

Without funding very few formal archiving activities exist. Only a small number of producers are capable of taking on the responsibility and costs of preserving their own materials, and preservation planning is largely an afterthought. The rapid changes in digital technology are rendering recording and playback systems obsolete at breakneck speeds, and while tools for managing large and complex video files are fast evolving, they are not yet perfected. This puts digitally produced programs at great risk of being lost, and potentially leaves a large gap in saving America's public television legacy.

U.S. public television stations WNET in New York and WGBH in Boston recognized this challenge. Between them, the two stations produce roughly 60% of the national prime time public television series in the U.S. including Frontline, NOVA, American Masters and Great Performances. Moreover, because WNET and WGBH each maintain its own archives, both stations had a demonstrated commitment to long-term program preservation. Both knew that solving the demands of digital preservation would be costly and that no station could do it alone – it would require a collaborative effort.

When the Library of Congress invited proposals through NDIIPP to promote digital preservation practices, WNET and WGBH formed a partnership with the Public Broadcasting Service (PBS) to develop a model repository for digital video. PBS operates the national network that distributes public television programs to more than 300 local stations across the country, and it is the principle de facto repository for national programming. The PBS warehouse holds more than 150,000 analog tapes going back more than 50 years.

WNET, WGBH and PBS are all directly engaged in producing, distributing and archiving television programs, and they shared a recognition that public television had to take steps to begin protecting its rapidly growing collection of digital assets. Because they are primarily broadcasters, however, they had little experience developing a preservation repository.

New York University provided the expertise that was lacking. The NYU Digital Library Technology Services team had extensive experience designing repository systems specifically for transferring and preserving large, video files wrapped in rich metadata. The project further benefited from a relationship with NYU's Moving Image Archiving and Preservation Masters Degree Program, whose students have produced excellent research as part of the project and whose graduates have become full-time project staff.

Project Goals: Build and Test a Model Repository

Understandably, the priorities of public broadcasting are program production and broadcast delivery, not saving program assets. Together, WNET, WGBH, PBS and NYU organized ***Preserving Digital Public Television***¹ as a collaboration to introduce digital preservation issues, practices and benefits to the public television system.

The project formally began in September 2004 and will be completed in 2009 with a main focus to develop a model preservation repository for large digital video files. Because public broadcasting as a whole has little exposure to preservation issues, the project also proposed examining issues related to content selection and appraisal, studying copyright impediments, and examining relevant financial and governance models for repository operations. An underlying goal was to promote an understanding within public broadcasting that to exploit its programming well into the future, digital preservation should be a new priority worthy of investment.

To be successful, *Preserving Digital Public Television* had to demonstrate that building a repository was technically possible, and that operating a repository was functionally and economically feasible. In this context the initial set of activities were:

- Designing a test repository for born-digital public television content.
- Developing standards for metadata, file formats, wrappers and production workflow practices.
- Drafting recommendations for appraisal and selection policies for public television content.
- Examining issues of long-term content accessibility and operational sustainability.

In planning for the NDIIPP project, the public television partners understood that identifying commonly used file formats and production protocols, determining appropriate metadata requirements, and adopting technical standards would be key. The project naively assumed that both commercial television networks and large collecting institutions like the Library of Congress, which was completing its Packard Campus of the National Audio-Visual Conservation Center, were making progress on solving these same problems and public television could benefit by joining in with work already underway.

The project quickly learned, however, that this was not the case. Other video producers, including the networks and the Library itself, were in fact struggling with the same technical issues. Instead of tagging along, the project found itself in the unanticipated position of leading the effort in the television industry to create a standard for video file wrappers, and adopting one of the first sets of metadata schema appropriate for long-term video preservation. Both of these outcomes were unexpected.

As for bringing a new consciousness to the system, our project has sparked widespread support to launch local as well as national preservation activities, and we helped prompt CPB to propose creating *The American Archive*, its first funding ever to support preservation services for U.S. public radio and television programming.

Using the OAIS Reference Model

Digital objects must undergo ongoing transformations within ever-changing technological systems to remain usable. File formats and software upgrades happen frequently, and once a digital object has been put in a repository or saved on a server, it is by no means «preserved.» Instead, digital files require duplication, auditing, migration and ongoing maintenance to remain accessible and usable. As Ken Thibodeau, Director of the Electronic Records Archives program at NARA, notes, «empirically, you cannot actually preserve an electronic record. You can only preserve the ability to reproduce the record.”²

The clear implication is that digital preservation is not merely file storage, but requires adequate infrastructure, facilities and resources to ensure that the files will be protected and remain readable over time. *Trustworthy Repositories Audit and Certification: Criteria and Checklist* (TRAC)³ is the currently recognized standard in the U.S. by which to measure a repository's capability of acting as trustworthy, sustainable, digital caretaker.⁴

Developed as a joint effort between the National Archives and Records Administration and the Research Libraries Group, TRAC provides guidelines for institutions that offer long term preservation services. The TRAC criteria follow the well-established, standardized functional requirements of a digital repository as outlined in the ISO Standard *Reference Model for an Open Archival Information System* (OAIS).⁵

The OAIS Reference Model provides a generic vocabulary for discussing digital preservation repository concepts based on broadly-supported standards and operational practices.

To meet the expectation of long-term file sustainability, the NYU Digital Library Technology Services team intended from the start that the model repository would become an OAIS-compliant Trusted Digital Repository, following the TRAC criteria. Functionality was designed around DSpace, an open-source software application used at NYU to store and manage other moving image collections, and technical issues rested primarily on how best to organize test files and metadata to create Submission Information Packages (SIPs) and Archival Information Packages (AIPs) following the OAIS construct.⁶

Testing Program Files

To test ingest and retrieval for the repository, the team used a sample of 35 hours of programming, both HD and standard definition files drawn from the national series *Nature*, *Frontline* and *Religion and Ethics Newsweekly*, plus a selection from the local program *New York Voices*. The test files originated from three sources – high resolution program masters from WNET and WGBH, and lower resolution distribution versions of the same programs from PBS. This collection of programs allowed the project to test of a mix of both high and low resolution program file formats. It also required the files to be accompanied by a wide range of metadata that was collected from multiple sources.

Collecting and Managing Metadata

Because the model repository does not input any new descriptive metadata, to create a useful Archival Information Packages (AIPs), sufficient information about each program file had to be packaged and sent along with the video as part of the Submission Information Package (SIP). The program SIPs therefore had to include the requisite metadata as well as the program files themselves.



Figure 1.

Diagram for a Digital Repository based on the OAIS Reference Model.

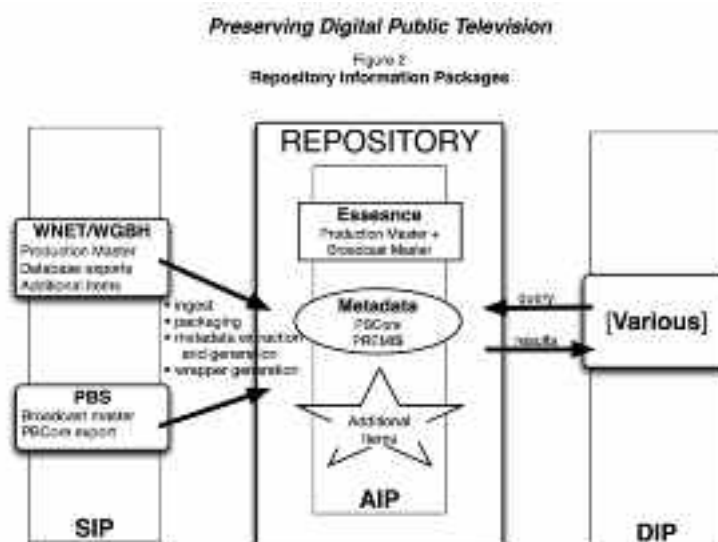


Figure 2. Repository Information Packages.

Determining an appropriate set of metadata fields was a detailed and intensive task. One fundamental requirement for each program was to aggregate its content with its metadata, regardless that they originated from disparate sources, such as from the producing station (the high-resolution production master) and also from PBS (lower-resolution broadcast master.) Database exports from each source also had to be analyzed, particularly the extensive descriptive and rights metadata created by PBS for broadcast scheduling.

The initial tests of the repository revealed that, because public television program producers in the US are largely independent, each operates with different software, hardware, production procedures and recordkeeping. This resulted in production master files submitted to the repository which came in a variety of encoding and wrapper formats and which were not equally easy to manage or playback.

The project also found there was very little consistency in the way metadata for each program was recorded, as producers created certain elements of metadata, PBS generated others, and all of it was saved in different modes for different purposes (i.e. production vs. distribution). Further, metadata was not collected consistently in a centralized place, even within PBS, so collecting it to meet the needs of the repository had to be done on a time consuming, program-by-program basis.

To organize such idiosyncratic metadata, the project examined a broad range of standard metadata schema used by libraries, archives and the commercial broadcast field. Project staff paid special attention to PBCore⁷ a metadata dictionary based on Dublin Core designed specifically for public radio and television program files, and PBCore was chosen early on as the appropriate standard to capture descriptive program metadata.

PBCore has been in development for several years, but remains in the early stages of system-wide adoption. Even so, the repository designed its descriptive metadata requirements around PBCore, and in the course of the project, all three of the public television partners have implemented PBCore-compliant export functionality for particular program databases.

Incorporating technical metadata embedded in the video files of the AIP also proved to be a challenge. The program files were submitted to the repository in a number of wrapper formats, including MXF and QuickTime, and encoding formats, including various flavors of MPEG and DVC Pro. These required multiple tools able to extract such technical metadata as bitrate, file size, and frame size, from the file headers. Because extracting technical metadata is critical for long term digital preservation and access, this was an important operation.

Standard Metadata Schema

Transforming the submitted and extracted metadata into standard formats was a clear necessity. The solution was to encapsulate the necessary descriptive and technical metadata, plus preservation and administrative metadata, from several data dictionary schema while maintaining information unique to public television programming.

The repository developed a structure to capture all necessary metadata using PBCore for descriptive and technical metadata, PREMIS for additional technical and preservation metadata, and METSRights for rights metadata. Appropriate fields from these standards, along with virtual links to the program files themselves, are all contained within a METS (Metadata Encoding and Transmission Standard) wrapper.

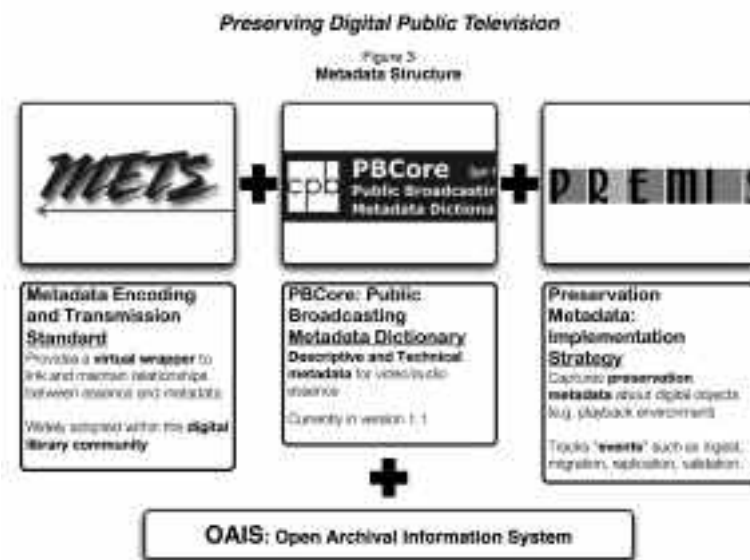


Figure 3. Metadata Schema.

The problems encountered by testing these various file formats, combined with the time-consuming efforts needed to collect metadata, demonstrated the necessity of setting uniform standards across the public television system for the success of any future repository operation. Otherwise, automating the functions of managing the metadata of large collections would not be feasible, and managing the video files themselves would be overwhelming.

Developing a File-based Video Production Workflow

With the understanding that preservation and other valuable metadata must be captured early in the process, the project examined program production workflows to identify points where key metadata are created. However, this turned out to be problematic because when the project began, production workflows were largely manual and the technology and digital asset management tools necessary to manage file-based video workflows were not in place.

That changed in the October 2008, when WNET launched WORLDFOCUS, a daily half-hour international news program that is pioneering a digital production workflow end-to-end. With cost-effective digital recording, editing and file transfers finally available, WORLDFOCUS provided the opportunity to test the preservation concepts of an actual file-based workflow for the first time.

The program is produced with video files coming from P2 field cameras, studio recordings and other sources, processed

through a central ingest facility at WNET. Most are encoded as DVCProHD files (also known as DV100,) which require minimal transcoding to normalize file formats. Instead, the DV100 files remain intact but are re-wrapped from de-multiplexed MXF into a single Quicktime file. Related PBCore metadata records are created at the same time.

The DV100 files are then transferred in-house for editing (on Final Cut Pro) and when the production is finished, they are sent to the broadcast servers for play-out. For transfer to the repository, the PBCore metadata record is added to the finalized DV100 program file to create the repository SIP. The digital workflow of WORLDFOCUS has allowed us to submit genuine born-digital source footage, as well as completed program episodes, to the repository for the first time.⁸

Search for a Standard Video File Wrapper

The use of a standardized video file wrapper is considered as a requirement for successfully exchanging digital files between entities, particularly to support future file migration. A number of so-called video wrapper “standards” exist, but despite vendor claims, the files do not all actually interoperate with many equipment configurations used by public broadcasters. Consequently, the search for a functional wrapper has been persistent.

Any initiative to create technical standards for public television must dovetail with the needs of the commercial broadcasting industry, because public television on its own does not carry enough economic clout to influence hardware vendors. To examine this issue, the project convened a “Wrapper Roundtable” of technologists, digital archivists and industry leaders in hopes that the networks had made progress and would share their findings. However, the group was surprised to learn that the lack of consistent wrapper standards was also a major problem for the commercial networks.

The wrapper standard remains to be solved, but due in part to the collaborative atmosphere established by the “Wrapper Roundtable,” the Advanced Media Workflow Association (which represents vendors) has launched the AS-03 wrapper project specifically to develop an MXF standard that vendors will support.⁹

Access and Sustainability

In addition to testing the repository model, *Preserving Digital Public Television* committed to evaluate the impact of rights restrictions on digital preservation and future access, and to examine issues relating to the long term sustainability of a repository operation. Both subjects are complex, and the project has produced two comprehensive reports that provide detailed analysis of each issue in relation to public television in the U.S.

Analyzing the Impact of Rights Restrictions

Television programs are comprised of a wide array of elements governed by rights restrictions and other encumbrances. Typically, rights to use this material for broadcast are granted for a finite period, and when the broadcast rights expire, the system no longer has an interest in the program. Specific authorization to preserve public television programs or make them accessible at the end of the broadcast window is largely absent, and renewing rights agreements to permit new uses (like on-line viewing) can be tremendously costly.

This is a problem that exists across television archives and collections. *Intellectual Property and Copyright Issues Relating to the Preservation and Future Accessibility of Digital Public Television Programs* outlines the problem in-depth and presents a number of case studies to illustrate the issues.¹⁰ Not having clear permission to reuse older programs is a primary factor that discourages public television from making an investment in long-term program preservation. Until rights agreements are improved, archival content will remain largely inaccessible.

Assessing Operating Costs

As existing digital repositories mature, operating conditions and issues are being documented by such institutions as The National Science Foundation, which commissioned the *Blue Ribbon Task Force on Sustainable Digital Preservation and Access* jointly with a number of other organizations in 2007 specifically to study economic models for maintaining large and diverse database repositories.¹¹

Instead of being seen as unaffordable, the costs to preserve digital public television had to be presented as feasible and manageable. Our report *Operating and Sustaining a Trusted Digital Repository for Public Television* discusses potential benefits of digital preservation and breaks down the technical and organizational expenses necessary to maintain a reasonable scale of repository operations.¹² It also outlines ways that public television might be able support a preservation program, based on existing income sources and operating models already familiar to the public broadcasting system. The intent is to demonstrate that with shared resources and commitment, a repository can be sustained.

Promoting System-wide Support

Since *Preserving Digital Public Television* began, broadcasting has shed its analog systems and moved completely into a digital universe. Because the project has been successful tying the concept of digital preservation to effective reuse of program content across viewing platforms, preservation has become highly relevant to stations — not an optional “add-on” cost, but a requirement for any future use of the materials.

Thus the project has been instrumental in transforming an attitude of indifference to one that acknowledges the value of properly managing our collective archival holdings. As evidence, CPB allocated funding for the very first time to pilot The American Archive, a national preservation effort for U.S. public radio and television.

Even so, despite the support from CPB, digital preservation is still not accepted system-wide as an important national investment. Viewers keep reminding us that public television programming is precious and has made an indelible imprint. What remains is to continue building commitment and enthusiasm across the entire system. The critical responsibility for saving the legacy of American public television must be shared, sustained and nurtured over time so our programs will indeed, have a life after broadcast.

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Nan Rubin has more than thirty years experience managing technology and facilities projects in public broadcasting in the United States. She has worked at public television station Thirteen/WNET-TV in New York City on such major efforts as restoring the station's broadcast signals after the destruction of the World Trade Center, and she planned and coordinated the creation of Thirteen's Tape Archive to preserve both analog and digital program assets. Since 2003, Ms. Rubin has been Project Director of Preserving Digital Public Television, funded by the Library of Congress's National Digital Information and Infrastructure Preservation Program (NDIIPP), where she oversees a team of 20 based at WNET, WGBH –TV in Boston, the Public Broadcasting Service, and New York University, who are building a model preservation repository for born-digital public television productions.

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Long-term digital preservation of a new media performance: "Can we re-perform it in 100 years?"

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Introduction

The technological boom of the mid 20th Century has inspired many artists who have been employing and adopting constantly evolving technology into their creative process, producing what is now generally called new media art. On one hand, this new art discipline may attract new audiences which are no longer addressed by static art forms like paintings or sculptures. At the same time exhibiting and preserving technology based art may easily become a nightmare for museums, galleries and archives [1].

Our work has been inspired by parallel efforts carried out in the projects "Archiving the Avant-Garde" [2], "Variable Media Network" [3], "Forging the Future" [4] and by the DOCAM alliance [5]. The major aim of these efforts is to document media art installations (art piece that usually do not involve live actors and can be exhibited in a museum or gallery in a similar way as a painting or sculpture). In contrast, we focused on media art performances that usually involve live actors (like dancers), are performed within a certain period of time and take place in a theatre or a similar place that enables the audience to watch (and possibly interact with) the event.

CASPAR approach

Most of our work has been completed under the support of the EC co-funded project CASPAR [6], which attempted to provide answers to the crucial question: How can digital data still be used and understood in the future when systems, software, and everyday knowledge continue to change? The project focuses on long-term preservation of cultural, artistic and scientific knowledge in its digital form, where long-term generally means long enough for hardware and software to become obsolete. The project came up with a loosely coupled component infrastructure based on OAIS reference model [7] that has been constantly tested and validated by three testbeds for each domain: cultural, artistic and scientific. In the artistic testbed, a substantial part was conducted by the IRCAM [8] focusing primarily on the preservation of musical performances based on MAX-MSP tool. Since our CIANT organization has been active in the domain of new media art for ten years and has produced several new media performances including ETUDE [9], V.I.R.U.S. [10] and GOLEM [11], our role in the project, together with ICSRIM [12] at University of Leeds was to complement the artistic testbed with other new media including video, computer generated graphics, motion capture technology, advanced lighting systems, etc.

Claiming that we are able to digitally preserve new media performance requires proof. All the partners involved in the artistic testbed agreed on a validation, which can be described very easily, though not easily achieved. The ultimate proof that the preserved information can be understood is simply the capability

of its future consumers to re-perform the original performance based only on the information provided by the archive and the knowledge the consumers possess at the time of the retrieval.

Achieving this proof of long-term digital preservation depends on two basic premises. First, the information to be preserved is in the digital form. Second, we are able to formulate proper representation information, which accompanies the raw digital data and is used to interpret it to produce information understandable to its consumers. These requirements look natural, though they are not easily met in the artistic domain, which is in contrast to the scientific domain not based on formal notations and standards.

Scientific testbed

Since CASPAR was expected to deliver unified preservation answers for different areas of human creativity, we decided to search for inspiration in the other two testbeds, the scientific and cultural one. One of the two scientific testbeds is conducted by ESRIN, the ESA Centre for Earth Observation [13]. The main subject of the preservation is earth observation missions, particularly the Global Ozone Monitoring Experiment. The observation instrument (ERS-2) measures the global ozone distributions and produces raw data (Level-0). To obtain end-user product in the form of GIF images (Level-4), some data processing through intermediate levels has to be done. However, it is not only the end-user product that is being preserved. The scientists hope that the future will bring much more sophisticated analytic methods. For this reason, the raw data and all the intermediary levels are being preserved too, together with the documentation of the observation instrument, workflow and algorithms necessary to process the data from one level to another. The result is a complex archival package that contains all the essential knowledge enabling the future scientists to understand each level of data and ideally not only to recreate the processing from the raw data to the original end-user product, but enhance the processing and the end-user product by utilising the future technology and algorithms.

Cultural testbed

The main subject of the cultural testbed conducted by the UNESCO [14] is preservation of documentation of the sites at the World Heritage List. Significant part of this documentation comprises of 3D reconstructions and photographs of the particular site. The 3D reconstruction process is very similar to the process described in the scientific testbed: the object of the reconstruction is scanned (by laser or cameras) which produces the raw data. This data is further processed through several intermediary levels (3D point cloud, polygons) until the final end-user product (3D model in VRML [15]) is achieved. The

motivation to preserve again not only the final product, but also the raw data together with the processing algorithms is clear: when much more efficient hardware and software tools are available in the future, it will be possible to make higher quality 3D reconstructions.

Artistic testbed

An obvious and direct analogy can be then drawn from the scientific and cultural testbeds to the artistic domain: the natural phenomenon we want to document is the performance; the instruments used to observe/scan/record the performance are microphones (audio) and video cameras (video); the raw data is the footage and the end-user product is the final cut of the performance on a DVD. The processing in this case is represented by the editing tool and its project file.

Even if this analogy is clear, archival package composed of the original footage, project file and final DVD provides only a limited source for the future artists to re-perform the performance. The performance is actually a result of a complex production and creative process originating from an abstract artistic idea. Thus, we have to shift our analogy a bit further and accept the fact that the end-user product is not the recording of the performance on DVD, but the performance itself. Then the processing would be the realisation process and the raw data would be the abstract artistic idea (work in terms of IFLA's FRBR [16]).

We are, however, still far from being able to read the artist's thoughts. Thus we have to step down one level and rely on the fact that the artist is able to convey his or her artistic idea in an understandable form to the performers and other people realising the performance. This information can be then considered realistic raw data in our analogy. In the classical performing art, there are several regularly used notations designed for this purpose.¹

Even though this raw data is of crucial importance for documentation, preservation and eventual re-performance, in many cases the author may produce his or her idea alone and the only thing that can be documented is the final performance. Similar situations arise when the author gives informal (e.g. oral) instructions that are never captured. It is obvious that if some information that was important for the realisation of the performance is missing, the re-performance based on incomplete documentation may neglect some important features and in the worst case it may not be possible to re-perform the performance at all. To resolve the danger of incompleteness, artistic partners in the CASPAR project believe that the most appropriate solution is to apply and extend Sheer curation [17] approach that ensures that as much information as possible is captured directly during the realisation of the performance.

Multimedia performance ontology

The second part of the article explains how we model and visualise the realisation of the performance including the raw data, processing, intermediary data and the end-user product – the new media performance itself. A new media performance is composed of the classical performing art elements (dance, music, theatre) enriched with new media elements such as speakers, microphones, lasers, light sensors, video projectors, mixing boards, computers, script and programs, audio samples, video loops, 3D models and more...

1. Musical notation (MusicXML or MIDI), movie script, choreography (Labanotation or Benesh Movement Notation).

From the preservation point of view, the data-production and data-transformation processes are the most interesting pieces of a performance. The fact that the processes depend on each other can be naturally represented as a network, and a timeline can be used to express their placement within the time-span of the whole performance.

Requirements

In order to formally describe an arbitrary multimedia performance, we first need to reduce the problem into smaller parts. We encode the information using the Resource Description Framework (RDF).

Basically, the ontology should cover two areas:

1. Description of objects and their relations within the scene.
2. Data flows with time intervals.

The former can be represented as a static graph describing relations among all objects used in the performance, together with the associated meta-data, for example: program name and version, the physical location of the projection screen, etc.

The latter deals with data flows and is focused on the time-aspect of the process, hence the projection on a timeline (Figure 1). Objects create, transform and exchange information in time.



Figure 1. Example of a timeline (GOLEM performance).

Building blocks

The very core of our model comprises three basic elements - Data, Process and Motivator grouped into building blocks as depicted in the Figure 2.

- The "Process" element represents data creation, transformation or other action such as recording, situated in a specific time interval.
- The "Data" elements are divided into inputs and results, usually manifested as files or data streams in the real world.
- The "Motivators" are all relevant physical or virtual objects involved in the process.

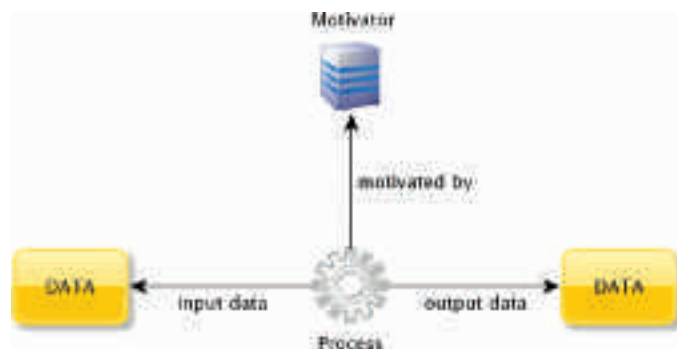


Figure 2. Basic elements of the ontology (basic building block).

By connecting these building blocks, every situation inside a performance, ranging from the initial artistic idea to the final product, can be described. Every process is associated with a time interval defining the process within the performance's time-span.

Expressing the ontology in CIDOC-CRM

In this paper, we present one of the many possible approaches of encoding our ontology, the CIDOC-CRM [18] model. Apart from the CIDOC itself, we also included additional semantics proposed by the University of Leeds - IMP [19].

For our purposes, we only used a tiny part of the whole CIDOC specification. We needed classes and properties that would fit the idea of the basic building blocks presented earlier. We took the CIDOC-CRM 4.2 ontology expressed in OWL, then we added the IMP ontology and fixed the missing statements in the CIDOC OWL file. Finally we aggregated everything into a new «Multimedia Performance Ontology» and used it as a basis for modelling of the GOLEM and VIRUS performances (see [11], [10]).

The mapping between our abstract notion of building blocks and the CIDOC+IMP follows:

- Our «Process» element can be expressed as a subclass of the «E65 Creation»
- Our «Motivator» element can be expressed as a subclass of any «E1 CRM Entity»
- Our «Data» element can be expressed as a subclass of the «E73 Information Object»

The links between the process and other elements are expressed with properties: P16 (used specific object) for data inputs, P94 (has created) for data output and P17 (was motivated by) for motivators. Figure 3 shows the CIDOC mapping in action.

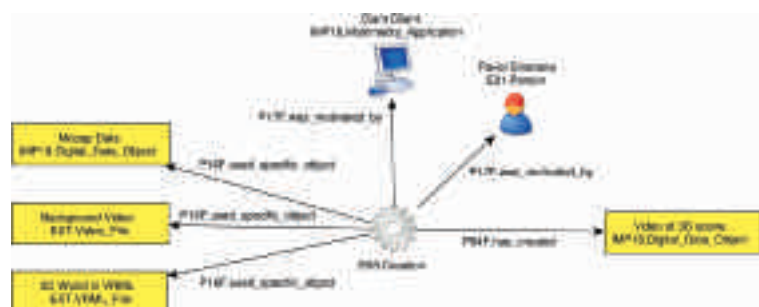


Figure 3. Data processing example using multiple inputs.

Preservation and visualisation

We designed a system for visualisation of performances. Metadata stored in the RDF repository² are processed by the «Ontology loader» component, which serves as a bridge between the ontology and the rest of the application. It understands the peculiarities of the CIDOC-CRM and the semantics of our CIDOC extensions. It also provides a modular architecture where other components, so called «Visualisation profiles», can register their event handlers. When the loading procedure is initiated, all registered observers would receive data depending on their focus. For instance:

- VRML profile would render the 3D scene in using the 3D geometry-related metadata.
- Media player profile would interpret video files by playing the video.
- Timeline profile would render a nice-looking timeline widget.
- Graph profile would render the RDF graph.
- Subtitles profile would display selected annotations.

At the very end of the loading process, a slider widget is started allowing user to synchronise all the components by sending UDP packets.³

Conclusion

Having reached this section, you may ask what actually the outcome is? How the artists or curators could possibly benefit from the presented ideas?

Our goal was to describe specific problems of multimedia performances comparing to the other forms of mostly static art genres. We focused on the time-aspect of the piece and using the analogy of how the scientists preserve their satellite scans, throughout the various processing layers, we designed a system which allows for storing data and metadata from various levels of the performance's lifespan. Moreover, we can visualise the stored information in a synchronised way, such as video captured from different angles.

We hope our approach would help the artists to preserve their precious creations for next generations.

2. Regular data files such as AVIs or MP3s are stored separately from the metadata.

3. An example could be the synchronisation of multiple video players showing the recorded performance from different angles.

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KEEP : L'Europe veille à ses documents électroniques

par Jean-Philippe Humblot

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Le projet KEEP est un des nombreux projets illustrant la volonté des institutions européennes de fédérer moyens et compétences pour la sauvegarde du patrimoine culturel européen. Dans ce cas précis, il s'agit de pérenniser la consultation des documents électroniques.

Trois défis

Les bibliothèques patrimoniales conservent des fonds polymorphes qui, pour certains, posent des défis techniques singuliers. C'est le cas des documents électroniques, à la durée de vie limitée et soumis à l'évolution technologique constante ou aux aléas du vieillissement des matériels de consultation (plateformes informatiques, consoles de jeu, etc.). Des recherches sont actuellement menées suivant trois axes. Dans un premier temps, il s'agit d'élaborer des techniques permettant la récupération des informations contenues sur les supports originaux (cassettes, disquettes, disques optiques, cartouches, etc.) et leur migration, ce qui suppose l'emploi d'appareils de lecture souvent anciens et nécessite de traiter les mécanismes anticopie. Ensuite, pour dénouer la dépendance envers des plateformes de consultation dont la bonne marche n'est pas garantie dans le temps, il faut concevoir des logiciels appelés émulateurs dont le rôle est de simuler le fonctionnement d'une machine donnée sur une machine contemporaine telle qu'un PC sous Windows. Se pose enfin la question de pérenniser ces logiciels eux-mêmes, l'expérience montrant que ce qui s'exécutait parfaitement sur le Windows d'hier ne fonctionne souvent plus sur celui d'aujourd'hui.

Trois objectifs

Le projet KEEP (pour *Keeping Emulation Environments Portable*) a pour premier objectif d'établir un cadre formel pour l'extraction d'information à partir de différents types de supports. Il s'agit du *Transfert tools framework*. Cela passe par la définition de formats de représentation (on parle d'« image » de support) et de métadonnées standardisés. En effet, il existe aujourd'hui un nombre foisonnant de formalismes permettant de rendre compte du contenu d'un type particulier de supports, en fonction par exemple de la plateforme cible ou des outils ayant permis de réaliser l'extraction. Une étape d'homogénéisation et de normalisation est un préalable indispensable. Cette étape va de pair avec la nécessité de définir un ensemble de métadonnées adaptées à ces supports afin d'en décrire les spécificités techniques sur le plan matériel et logiciel.

Un autre aspect abordé par le cadre d'extraction porte sur le recueil et la création d'outils logiciels ou matériels nécessaires à la copie des supports. Il en existe aujourd'hui un grand nombre développé par des éditeurs de logiciels spécialisés aussi bien que par des individus passionnés. L'enjeu consiste à intégrer ces outils

au sein d'un environnement homogène et convivial à l'usage des conservateurs, et de faciliter le renseignement des métadonnées attachées aux images de support qui seront produites.

Dernier aspect, ces travaux doivent permettre de tenir compte des contraintes liées au respect du droit des auteurs et ayants droit, mais réciproquement, ce dernier ne saurait s'opposer à la mission de préservation d'éléments singuliers du patrimoine culturel contemporain. Aussi, les fondements juridiques seront examinés de près et pourront donner lieu à de nouvelles préconisations à l'usage du législateur.

Le second objectif du projet consiste à définir un formalisme pour la programmation d'émulateurs (baptisé *Emulation framework*) de façon modulaire et en intégrant des services conformes aux besoins des chercheurs, tels que la sauvegarde d'états ou de parcours de consultation, l'extraction de données, l'aide contextuelle, etc. Ce formalisme doit permettre de répondre à un double enjeu : faciliter le développement de nouveaux émulateurs en réutilisant des modules déjà développés et validés ; et favoriser la pérennisation des émulateurs en limitant les technologies informatiques utilisées à un sous-ensemble bien défini et standardisé en termes de langage informatique et de librairies de programmation.

Enfin, la partie la plus innovante du projet vise à réaliser une machine virtuelle universelle chargée d'exécuter ces émulateurs et caractérisée par sa portabilité : ce logiciel devra pouvoir être adapté facilement à n'importe quelle architecture informatique future, de façon à rendre pérenne la plateforme d'émulation. Pour cela, la machine virtuelle sera basée sur un jeu d'instructions réduit et disposera de capacités auto-adaptatives permettant d'alléger les efforts nécessaires pour rendre exploitables des périphériques (équivalent des actuels écran, clavier, souris...) aujourd'hui inconnus et qui apparaîtront à l'avenir.

Et un réseau de compétences

Mené avec le soutien de la Commission européenne dans le cadre de son action en faveur de la sauvegarde du patrimoine numérique, le projet KEEP cherche à élaborer des réponses à ces enjeux en fédérant les efforts d'institutions patrimoniales et de sociétés privées européennes. Neuf partenaires s'y emploient depuis février 2009 : outre la BnF, coordinatrice du projet, il s'agit des bibliothèques nationales des Pays-Bas et d'Allemagne, du Musée du Jeu vidéo de Berlin, de l'université de Portsmouth, des sociétés informatiques Jogu SAS et Tessella, et de deux sociétés, Cross Czech et EGDF, chargées de la promotion du projet et du rapprochement avec les communautés éparses mais très actives de développeurs ou d'utilisateurs de jeux vidéo.

Pour plus d'information sur le projet KEEP :
<http://www.keep-project.eu/>

"KEEP (Keeping Emulation Environments Portable) will develop an Emulation Access Platform to enable accurate rendering of both static and dynamic digital objects: text, sound, and image files; multimedia documents, websites, databases, videogames etc. The overall aim of the project is to facilitate universal access to our cultural heritage by developing flexible tools for accessing and storing a wide range of digital objects."
You can find more information in English on this project on Corbis website: <http://cordis.europa.eu/>

Technical and normative scenarios in the medium and long term for libraries audiovisual collections

by **Henri Hudrisier**,

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and **Alain Vaucelle**, Lecturer and Researcher, ARTEMIS, TELECOM SudParis

In terms of heritage it is probably appropriate to quote a sentence attributed to St. Bernard: "Ecclesia ante and retro occulata." This attention to the future, to what is available here and now and the lessons of the past are the three additional positions that we want to see taken by those who are today in charge of maintaining, managing, processing, documenting, providing users, in short of inventing the library of tomorrow including NBM collections (Non Book Material).

Audiovisual heritage preservation, cataloguing and documentary analysis are important topical issues for libraries. Indeed for many reasons the image integration to book collections (and even more for audio) has been historically complex². This is traditionally the case for the integration of audio/visual collections into libraries where they are still kept separate for obvious reasons of specific conservation, or for availability and analysis. On the other hand, the semantics of image and/or sound (musical without language) pose many documentary challenges counter to the now out-of-date vulgate: any thought can be reduced to a linguistic statement transcribed to text. In addition, the simple concept of copyright and publisher is considerably more complex for films (or video) content, because the worldwide distribution of audiovisual (as film, video or DVD) implies a polymorphous multilingualism and an adaptation³ by format, type of players and standards zones⁴, much more diverse than for books. The 19th and then 20th century analog media have faced major heritage collections to an exponential increase of NBM. The first period of main media digitization (CD, CDRom, DVD) have spread the phenomenon of content heterogeneity (multimedia) for almost all the libraries. Alongside the globalization of networks, exchange and development of cooperative cataloguing, creation of common catalogues to all media, the general Web and its symbiosis with progressive tools and libraries methods have changed the librarians' profession, and probably more for audiovisual librarians. The multimedia library is the common lot of any librarian.

Here lies the true failure. In a few years the departments of audio-visual libraries have seen their activity grow and change. However libraries are faced with the convergence of "all digital".

This convergence will know a much greater acceleration with the abandonment of analog broadcast in the early 2010s. This issue concerns of course firstly audiovisual film and video (which will know considerable changes and in particular the availability of audiovisual corpus downloadable on demand). It

will have very important effects on the multimedia in general (sound, photography, imagery in all its forms) and of course on any digital content regardless of the terms (semantic Web, digital libraries of text and non-textual...).

For audiovisual professionals, museums, libraries, archives are becoming a significant resource for their programming. Tomorrow, multimedia corpus will be subject to archiving and "media transfer". This convergence requires us to question the document definition; it can no longer be simply seen as a "technical" support, but rather with a semiotic approach. The individual link to the document is changing. Mutations affecting the document concern the transformation and modification that the user can perform on the content, as the document fragmentation into multiple entities. The document is no longer one, it becomes a documentary chaining, calling for new methods for information treatment and documentation process.

We would like to stress also some fundamental characteristics of the increasing convergence of media. Media convergence appears because professions make common standards⁵ (field that all the librarians know and especially those involved in IFLA works). For example, the mobile phone is both a phone, a GPS guidance tool, a PDA, a camera, a TV or radio receiver, an audio player, a voice recorder, an email terminal, a SMS, game consoles, an alarm clock, a calculator, a payment terminal, etc., only because all these formerly distinct industrial activities understood they could find there a larger market. Indeed the convergence of multimedia standard generates not only multimodal innovation and interoperability advantages, but also economy. One can even say that Moore's law⁶ is a direct consequence of the standardization effort. For instance, in the 80s, you had to pay about 1 million of French Francs to provide a tool for displaying and sorting images with a videodisc (documentary imager); today the same can be done with much better conditions (volume, image quality, speed, ergonomics) with a computer which costs 200 € and using free and open source software. So the overall digitization of information and communication leads to very significant economy, security processing, storage and broadcasting effects. That's why the scheduled abandonment of analog broadcast at the turn of the 2010s will be so important.

1. "The Church needs to look ahead but also at the past."

2. The photo-engraving is only dated from the beginning of the 20th century and the typesetting on a single page of text and images (especially in colour) was complex.

3. VO, VO subtitled in N languages, version doubled in N languages, version with closed captioning for the hearing impaired.

4. 8mm, 9.5mm, 16mm, 35mm, 70mm, SECAM, PAL, NTSC, Zone area A, B, C, D..., DVD, DVD, Blu-ray...

5. For example, the mobile phone or PAD are current tools to process, store and distribute photos, video, email, internet, sound or music phone, SMS, games, number of desktop applications, the GPS, online payments... This is because the experts of standardization have actually met to establish common interoperability for the implementation and use of these different components of communication possible on a phone. What will happen with the widespread use of digital broadcast is exactly the same because it will be a convergence as important as the one we observe on mobile phone.

6. The Moore's Law plans the exponential increase in microprocessor performance computers.

The effects of delay and inertia in appropriation and uses

Although tools and standards have been identified and developed industrially, they spread only when the practices are in place, which inevitably implies new practices. It is a constant of technological developments: once the period of invention and availability of a first generation of tools has passed, a technical system (here the digital image) can spread on a larger scale only if a majority of users adopt without delay new paradigms by assessing the potential uses and especially rethinking their techno-culture in the light of future technology opening up to them.

However, social inertia is inevitable. Some professions such as aviation, army, post-production film and medicine have a low inertia in new tools appropriation as they are waiting for them. However, many professionals (librarians, museographers, teachers, publishers), individual or semi-professional users have no desire to see the organization of audiovisual resources radically change every 5 years in terms of formats, tools and software.

Regarding private users (mostly poorly informed), they are condemned to suffer the law of supply: they have to balance between the disadvantages of their audiovisual equipment obsolescence and the cost of periodical investments. The problem is rather different for professionals, including those in charge of the audiovisual heritage issue. These professionals have a responsibility to perpetuate over "centuries" a technical documentary universe. They must integrate with great care innovations to ensure the continuity of conservation and public access. However, they should not be "cut from the dominant technical system of ICT", which guarantees their ability to keep on operating within their budget provision.

Unlike what is too often perceived by those in charge of the finance, the disadvantages and costs are less the purchase of new equipment than the adaptation of the methods of scanning, storage, description and broadcasting system. It becomes every year more essential to understand the scenarios of the future development of audiovisual and multimedia. It is therefore a work of anticipation consisting in creating models and experiments by using what is evolving in the technologies of reading, storage and broadcasting for the mass market and professionals. It is indeed certain that these technologies will know a great success due to the planned and concerted abandonment of all analog broadcast (anticipated for almost ten years). This anticipation enabled researchers, standards developers, manufacturers, broadcasters and producers of audiovisual programs to predict their development, reorganize their work, mode of dissemination and marketing. They had no alternative anyway because they are influenced by the web 2.0 (semantic web) that evolves according to its own logic to be "semantic and multimedia".

Convergence and cross-attractions

Saying that audiovisual professionals are influenced by and dependent on Web 2.0 today is true but the contrary will be certainly true in 5 to 10 years. Indeed, as well as «the vanquished Greece [Audiovisual] conquered in its turn its wild conqueror [Web]», it is certain that the audio-visual mass market (TV, Blu-ray DVD, CD, radio) is incommensurate with the market of the conscious access, logical and rational to the Web or to any software or computer. It is also not commensurate with that of education, museums and libraries (and even with the

games market although this one is more and more linked to the audiovisual market).

It is certain that the professional production and development of audiovisual archives will be organized to be compatible with the tools and standards of the mass market mostly defined in MPEG-4, 7 and 21. From this point of view the turn of the 2010s will be crucial as it will see the emergence of very large resources of VOD (several hundred million of citations available online).

MPEG-4 and 7 generate the construction of a semantic language of audiovisual documentation. These standards create a convergence in the same «full media» universe. This vision of the future for the video offers a documentary integration, in which descriptors are represented using XML, which makes this semantic «understandable». MPEG-21 will socioeconomically fluid the access to content because it organizes the management of e-procurement⁷ and copyright. On a more general level, MPEG-21 architecture provides the standard of the production and distribution of all digital content.

It is obvious that a certain number of professionals of archives, libraries, museums or educational resources are organized according to technological paradigms belonging to the earlier audiovisual documentary system.

Some resistance may slow down the integration of this new technical logic which will include a maximum of tools and components belonging to the future emergence of mass VOD (note that this mass VOD will generate necessarily two versus of the same audiovisual documentation system based on MPEG-4, 7 & 21: a professional versus intended to broadcaster of VOD system and a mass market versus). Anyway this documentary audiovisual system based on MPEG-4, 7 & 21 will see its price collapse which will have a drastic influence on the costs of the organization and the supply of audiovisual resources whether online or in the library. This will have a major impact on the audiovisual heritage.

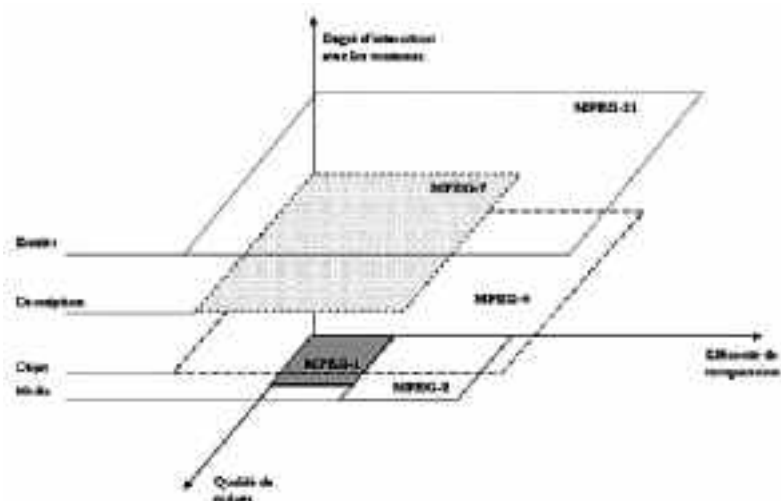
What about standards MPEG-4, 7 & 21?

The first standards of the MPEG family (1 & 2) were designed to optimize issues related to the compression of audio-visual stream. As these issues found a number of normative responses, other projects related to the document structure and its exchange have been launched. MPEG-4 is the standard-setting organization of an audiovisual media fully interactive and structured according to the principles of markup languages. MPEG-7 organizes the documentation standards in the multimedia field. This is an automatic or semi-automatic indexation of multimedia content. MPEG-21 is the standard-setting organization for the integration of services (e-procurement and copyright management) in the entire multimedia field. It is thus possible to describe the contents and elements that may interact from the creator to the user or the final «re-user».

This logic of corpus repository of digital documents is at the heart of this technology. It is very difficult today to predict the type of appropriation or misappropriation of the new uses offered by the family of MPEG standards. The existing audiovisual industry is likely to be changed and restructured. Video

7. By this term, we mean the broader concept of trade and exchange.

record, production, post and pre-production, editing, script, special effects, storage, distribution, recovery of contents and archiving will be transformed.



1. The different MPEG standards and their characteristics in terms of quality of coding, compression efficiency and interactivity.

The reasons for such resistance of documentation profession

When you have hundreds of thousands of audiovisual references ready to be used, it is legitimate not to rush when an innovation is launched, since it has a cost to re-treat this large amount of information that must be balanced with the savings generated by the new generation technology. A contrario these new tools will create much automatism that will change the organization of human resources, create transfer of activities inside and outside the heritage institutions, and will redeploy the staff activities.

This is why audiovisuals librarians must not only experiment these developing tools but be involved in the creation of standards (primarily ISO/IEC JTC1 SC29) and be closer to the research and development groups. This is the prerequisite if audiovisual librarians want their technical and standard specific requirements to be taken into account.

Great opportunities for the documentation engineering and knowledge of librarians, archivists and museums

If audiovisual librarians are involved in developing these standards and emerging tools, they will provide theoretical knowledge and a long practice which will not only give us the specificities they need but will also allow to federate uses and professions demanding audiovisual archives, but not necessarily in a direct line with the mass market of VOD uses or conventional audiovisual archives. For example, teachers have a growing need to use online educational resources of visual or audiovisual content of high quality. Administrations, enterprises, security, designers, artists, scientists, publishers..., everyone needs access to audiovisual resources, but more often this demand is part of a larger need for a collective common catalogue that librarians manage perfectly.

On the other hand, professional, semi-professional or even private uses will also correspond to the organizational characteristics of commercial offers online which will not necessarily, even at the level of audio and visual resources, be limited to an organization by type of media with specific contents (video or film editing, phonogram, TV or radio heritage, pictures library, prints collection, or paintings, etc.). A great number of users are looking for mixed media and communication methods. These needs don't exclude the fact that a large proportion of the population of industrialized country or semi-developed countries is in demand of TV or radio programs. This content is offered or sold and distributed in the form of an uninterrupted and diversified⁸ flow of audiovisual program. The broadcasters can respond to this demand by proposing a content stream. On the contrary, if it is a rich and varied need, the methods of cataloguing and documentary analysis will be very diverse. It will therefore be helpful if librarians are in a position to unify this offer.

A society of shared knowledge

Do not trust in a technological determinism that reduces the evolution as mechanics of technology, whose wheels are essentially in a small number of specialists' hands. On the contrary, civil society, institutions, policies must be committed to a society of knowledge shared by all. These goals are ambitious to reach the global circulation of knowledge for all digital content; it requires financial resources, social commitments, states cooperation, and a private-sector involvement.

Education, access to ICT and contents, the development of a collaborative work, the flow and sharing of knowledge, multilingualism, standardization, partnership (government, paragonovernmental, private sector, international organization, etc.), documentation engineering can all contribute to the transmission and sharing of knowledge. Conservation, documentation are therefore part of a constantly changing process in which they have a role to play in the dissemination and access to knowledge.

Web 2.0, offers a new knowledge management, as the user becomes a contributor to the digital document, an actor and a spectator of the knowledge community. Web 2.0 prefigures, especially in its later versions, an organization of knowledge based on a logic of documentary consistency, consisting in combining linguistic multiplicity and «plural semantics» according to specialty and discipline, that will correspond more to the documentary logic than to Web search engines in their current state. This is the consequence of other convergence logics more textual, themselves depending on standardization not only documentary (ISO TC46), but terminological and multilingual (ISO TC37), specific to ontologies (OWL of W3C)... but that is another issue that we intend to handle in another article.

8. Without playing the over-intellectualism card, we can note that this passive addiction to audiovisual consumption is fairly shared by all levels of society.

Conservation and Preservation in Malaysia and Singapore

by Aurélie Bosc,

Curator of Rare Books and Manuscripts

Conservation and Preservation Centers are relatively recent institutional divisions in Malaysia and Singapore, yet they have a strong experience and expertise in the field, skilled staff and state-of-the-art techniques and materials. Although there are other conservation centers in the region, three particularly caught our attention, namely the Singapore National Archives Conservation Laboratory, as it does the conservation work for the National Library Board Rare Book Collection ; the National Library of Malaysia Preservation Division, Kuala Lumpur, as it only deals with manuscripts; and the Islamic Arts Museum Malaysia Conservation Centre, Kuala Lumpur, as it opened recently and deals with all kinds of materials, including paper.

Preservation at the National Archives of Singapore¹

The National Archives of Singapore (NAS) was established in 1968, to collect, preserve and manage Singapore's public and private archival records of national and historical significance—the earliest documents dating back to the beginning of the 19th century. The NAS became part of the National Heritage Board when it was instituted in 1993. As of 2006, NAS holds 10,855 linear meters of paper records, 292,226 microfilms reels, 4.6 million images, 15,690 hours of oral history recordings and 81,580 hours of audio-visual recordings. Since 2000, www.a2o.com.sg proposes online access to the collections, thus reducing the need to access to original documents.

Archives Conservation Laboratory

Each document to be archived undergoes anoxic treatment. Two fumigation chambers (5 days cycle) are located on the main site and another one (3 days cycle) is located at the "Memory of Old Ford Factory" site. Treatments done by the laboratory include: surface cleaning, manual repairs, de-acidification (especially wet process), leaf casting, tissue mounting, mylar encapsulation, binding and hot stamping.

The leaf casting machine was in-house made 20 years ago. However it has been improved over the years. The quantity of paper paste needed is automatically assessed by an Excel program using Photoshop to calculate the surface of the document to be filled up. Another new development links the storage tank to the leaf casting machine, thus permitting the required quantity of paper paste preparation to be automatically sent to the machine.

The NAS conservation and preservation services give training to staff from ASEAN countries like recently, Vietnam.

1. www.nhb.gov.sg/NAS.



1. National Archives of Singapore, Conservation laboratory. © AB

The Conservation laboratory employs 7 full time plus 12 part time staff, dedicated on external projects, such as the Botanical Gardens and the National Library Board (NLB) Rare Book Collection collections. The NAS worked very closely with the NLB in 2004-2007, with the opening of NLB's new building and the re-organization and preservation of the heritage collections. The project involved the fumigation, conservation, micro-filming (for both consultation and preservation purposes) and digitization of 100,000 rare and heritage materials and most of the conservation work was outsourced to the NAS. A second preservation project involving 200,000 documents and scheduled to end in 2008, has been outsourced to private vendors (one for conservation repair and microfilming, the other for digitization), as the NAS alone would not be able to cope with this huge number of materials².

Image Preservation Laboratory

Collected records from government agencies, after having been prepared (unbound, surface cleaned, ironed...), are scanned and written onto microfilm by digital microfilm writers for long term preservation. Original records with only informative value are disposed of, while those with intrinsic value are conserved and restored.

2. See "Preservation Programmes at the National Library Board, Singapore", by Mohamed Bin Salim, paper presented at the CDNLAO meeting in Bali, 8th of May 2007, <http://www.nla.gov.au/lap/cdnla02007.html>.

Preservation of Audiovisual materials

The NAS has a collection of 20,000 audio-visual documents, which are being digitized, both by the NAS staff and private companies. The NAS has signed memorandums of understanding with broadcasting stations and NGOs (e.g. ASEAN Films Archives), on preserving public service broadcast programs and raw footage.

Besides this collecting and preserving activities, the NAS makes proactive efforts in documenting changing landscape of Singapore, by creating its own pictures and videos (e.g. Old Drama Centre before its demolition). Singapore Formula One Grand Prix and Singaporean participation in Beijing Olympics will probably be the two major 2008 subjects to be documented by the NAS in audio-visual documents.

Repositories

A new repository has been built in 2005 on the "Memory of Old Ford Factory" site, specially designed for energy savings, with features such as a roof garden which lowers the temperature by 1°C under the roof, additional sealing of repositories and use of nano paint to address air-con leakage.

In 2003, the NAS achieved ISO 9001:2000 certification in imaging and conservation services. The NAS preservation and conservation activities are a landmark in the Singaporean heritage landscape, not only for paper (hence the collaboration for the National Library of Singapore), but for audio-visual materials as well.

Preservation Division – National Library of Malaysia, Kuala Lumpur³

The National Library of Malaysia, founded in 1966, hosts the 1985 established Centre for Malay manuscripts. It has a collection of over 4,400 Malay manuscripts, growing each year by donations or acquisitions from Malaysia and surrounding countries. Malay manuscripts are written in Jawi (Arabic script adapted to write the Malay language) and date from the early 16th century until the 20th century. They cover a wide range of subjects: literature, history, religious Islamic teachings, medicine and court customs. The most famous among them is the Hikayat Hang Tuah, a traditional epic about Hang Tuah who dedicated his life to serving the Sultan of Malacca in the 15th century. This 19th century manuscript is listed in the UNESCO Memory of the World Register.

Malay manuscripts are subject to deterioration due to their fragile condition (unbound items, acidic paper and ink). The National Library of Malaysia Preservation Division opened in 1979. Their purpose is to preserve and restore national collections: Malay manuscripts and national heritage such as rare books, documents deposited by the Legal Deposit Act (1966) and personal collections donated to the library. The tasks range from restoration, binding and microfilming, to maintenance

work in the stack rooms. Under tropical climate, a steady rate of humidity is not easy to maintain: mobile units of dehumidifiers have to be used to temporally to complement the fixed dehumidifiers. Silica gel packs are placed every 4 square feet to work locally and are regularly changed. Thermohydropographs are checked every day, and especially after heavy rains. As for infestations, silverfishes are the more common plague in store rooms. Preservation folders or acid-free boxes are used to store the manuscripts and are kept flat on the stacks.

Experts from Korea, Germany, Russia and Italy came here to share their knowledge. Carlo Federici from the Istituto Centrale di Patologia del Libro came in 2000 and introduced non-invasive restoration techniques described below. He stopped the use of silk for lining and the habit of binding unbound manuscript, which are now left unbound.



2. National Library of Malaysia, Manuscript dry cleaning. © AB

The workflow includes fumigation (outsourced)-each material entering the collection being fumigated-, dry cleaning, pagination (no stamping is done on manuscripts), PH testing, and if appropriate, dry de-acidification process (methanol + barium hydroxide), applying carboxy methylcellulose to reinforce the document on one side with machine made roll tissue, and eventually drying. Scouring is then done with surgical knife. This technique has a 2 sheets per day output. Alternatively, leaf casting is used if the document is in a good structural condition (8 sheets per day). Manuscripts in quite good condition are only dust cleaned. As for de-acidification, whereas the dry process is used for manuscripts, the wet process (magnesium carbonate + carbon dioxide) is used for printed books. Crompton tissue lining is used for printed books as well.



3. National Library of Malaysia, Manuscript after restoration. © AB

3. <http://www.pnm.my>.

Another aspect of the mission of the Division is to microfilm the manuscript. This is done step by step, 872 having been micro-filmed up to date, while a selection of 500 manuscripts has been digitized for online display purposes. Microfilming can be done on site using a mobile unit, for materials that do not belong to the National Library. This is the case just now in Buton Island, Indonesia, as a 2 years joined project with the University of Malaya, to microfilm, repair and catalogue family owned Malay manuscripts is going on.

The Preservation Division has 33 staff, including 22 conservators, who have been trained at the National Archives and Museums, or even in Germany or India.

The Preservation Division also acts as a resource center for other libraries: it gives trainings, advisory work, and guidance for libraries about preservation basics. It welcomes students from Kuala Lumpur and around, twice a week.

Conservation Centre, Islamic Arts Museum Malaysia⁴

Open in 1998, the Islamic Arts Museum Malaysia is the largest museum of Islamic art in South-East Asia, housing more than 7000 artifacts, with emphasis on China, India and the Malay world. A specific gallery is dedicated to manuscripts, where jewels of a collection of over 5000 items are displayed.



4. Islamic Arts Museum Malaysia, Conservation Centre. © AB

To conserve and restore these artifacts, the Conservation Centre opened in 2003 and now has 15 staff. Interestingly, the Deputy Head retired from the National Archives of Malaysia and came to set up the Conservation Centre and share its expertise.

The Centre is divided into 4 laboratories:

- laboratory for inorganic material (metal, glass, ceramic,...);
- laboratory for organic material (especially paper and textile);
- wet laboratory (cleaning of artifacts);
- analytical laboratory (research on artifacts).

Before entering the collections, artifacts are kept in a "waiting room" for observation. Doubtful objects are placed under quarantine: they undergo a low oxygen fumigation and are placed in a sealed atmosphere. Booklice and fungus being the

most common plagues, a brand new mobile treatment unit has been acquired to facilitate in situ fungus cleaning treatment, especially if a case occurs in the display galleries.



5. Islamic Arts Museum Malaysia, Manuscript Gallery. © AB

Three conservators specialized in paper and parchment deal with printed books, manuscripts, scrolls and bindings.

Restoration of 30 Chinese paper scrolls is going on, either for wall hanging or frame mounting - according to the thickness of the paper and the size of the scroll. Basic treatment includes removing the backing that creases and breaks the scroll, cleaning, removing stains, doing minor repairs, replacing the backing by a back lining with Kozo paper, and retouching. Minor repairs on the front side are taken out after the lining is in place.

Book repairs include rebinding and repairing modern books from the Museum library, as well as restoring manuscripts with dry cleaning, Kozo paper repair, de-acidification (dry process), Buckram binding or acid-free paper wrapping, if the volume is thin.

Leaf casting is only used for printed documents, whereas if needed, manuscripts are reinforced with Kozo or tissue paper. Customized conservation boxes are made from cardboard, coated outside with Buckram and inside with acid-free paper. Mylar encapsulation is another task done by the paper division. Each step of treatment is fully documented by photographs and a written report.

Part of the conservation work includes regularly checking light, temperature and humidity in the galleries where artifacts are displayed, as well as in store rooms. In the showcases, a temperature and humidity card is used to eye check the environmental conditions.

Conservation Centre Staff regularly attends ICOM and various overseas trainings and in return trains staff from other Malaysian institutions.

By using conservation facilities adapted to the specific local needs and sharing their expertise, these three centres play a key role in preserving South-East Asia heritage for the future generations in actively raising awareness to safeguard precious collections.

4. <http://www.iamm.org.my> and <http://www.iamm.org.my/conservation.php>.

Publications

Translations

Two translations into Portuguese, edited by Maria Luísa Cabral, Biblioteca nacional de Portugal, have to be pointed out:

- *Prevenção de Desastres e Planos de Emergência*, Manual básico da IFLA, John McIlwaine, Lisboa: Biblioteca nacional de Portugal, 2008 (Publicações técnicas. Preservação e conservação; 3) ISBN 978-972-565-424-8

- *Controlo de pragas em museus, arquivos e casas históricas*, David Pinniger, Lisboa: Biblioteca nacional de Portugal, 2008 (Publicações técnicas. Preservação e conservação; 6) ISBN 978-972-565-388-3

pay registration fees on line at:
<http://liber2009.biu-toulouse.fr/registration>

LIBER Member full registration until 15th May : 170 €uros
LIBER Member late registration after 15th May: 340 €uros
Non Member full registration : 340 €uros

Contact
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IFLA Satellite Conference, "Conservation and Preservation of Library Materials in a Cultural-Heritage Context", August 31-September 2, Rome, Italy

The IFLA Preservation and Conservation Section and the IFLA PAC-Core Activity are pleased to announce a Satellite Conference in conjunction with this year's IFLA World Library Information Conference in Milan. The satellite Conference will take place in Rome, August 31-September 2, at the Istituto Centrale per il Restauro e la Conservazione del Patrimonio Archivistico e Librario.

The first day (Monday 31 August) will feature preservation and conservation activities at:

- * The Vatican Library
- * The Istituto Centrale per il Restauro e la Conservazione del Patrimonio Archivistico e Librario.

The second day (Tuesday 1 September) will include two sessions, focusing respectively on topics associated with the following:

- (1) Robotic mass digitisation of cultural heritage library materials
- (2) Exhibition advances for cultural heritage library materials

Fees: 50 €uros

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IFLA-PAC Cycle "Preservation and the four elements", 2nd conference: "Water Impact on Library, Archival and Museum Materials", October 29-31, 2009, Prague, Czech Republic

The conference is the second part of a four-conference cycle, initiated by IFLA-PAC Core activity, focused on cultural heritage preservation and the four elements, Air, Water, Fire and Earth. The first conference on Air was held at The Bibliothèque nationale de France on March 5-6, 2009 (See report p. 43). The second one, held in Prague, is dedicated to the possible dangers due to water hanging over cultural heritage. Earthquakes, floods, winds and fires demonstrated their destructive power recently in Burma or in China just to remind us that disaster planning is not what you are planning for, but rather how we are prepared to overcome its consequences.

Programme

The National library of the Czech Republic, the National Archives of the Czech Republic in cooperation with IFLA-PAC are issuing the call for papers for forthcoming conference on water damages to the collective materials from museum, archives and library collection. During the conference following aspects will be discussed:

- Preparedness for the disaster to come, on the level of an individual institution as well as on the level of central and local administrative and their mutual cooperation.
- Rehabilitation of damages items – drying, cleaning, fumigating, storing.
- Rehabilitation of the water damages premises; buildings: drying, cleaning, fumigating.
- Learning from the experience: an international cooperation, creation of conservation crises center and quick intervention units on international bases.

A detailed program will be available as soon as possible.
The Conference fee will be 100 €uros.

More information on:
<http://www.ifla.org/VI/4/pac.htm>

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water2009@nkp.cz

Reports

Stage « Conservation préventive dans les bibliothèques et archives d'Afrique de l'Ouest francophone », 5-9 janvier 2009, Porto-Novo, Bénin
Par **Christiane Baryla**

C'est à Porto-Novo, capitale du Bénin que le programme PAC a organisé un stage de

Events and Training

Announcements

LIBER 38th Annual General Conference 2009, "Innovation through Collaboration", 30 June-3 July 2009, University of Toulouse, France

Organised jointly by Toulouse University Libraries Network and the Library Services of the University of Toulouse 1, the Conference will be hosted by the Social Sciences University of Toulouse 1, a campus university very close to the historical centre of the city.

The general theme of the conference is 'Innovation through Collaboration', and the conference itself will be innovative, offering a wide range of session's format: Plenary sessions, Break Out sessions, Current Issues, Master Classes, and Poster Sessions.

You can find the programme at:
<http://liber2009.biu-toulouse.fr>

Registration
You can download the registration form and

formation à la conservation préventive. Sans le financement de Sida (Swedish international development cooperation agency - www.sida.se) via le programme IFLA-ALP (Action for development through libraries programme), ce stage n'aurait pu avoir lieu. Je souhaite remercier vivement Birgitta Sandell et Gunilla Natvig pour leur efficace soutien et leurs conseils avisés. L'UNESCO a également bien voulu aider financièrement le projet à travers sa mission locale du Bénin. Enfin n'oublions pas le soutien logistique de la société EBSCO.

Que retenir d'une telle opération, la première du genre pour le PAC ?

- D'abord une action « sur le terrain », au plus près des lieux de conservation concernés et dans les conditions locales auxquelles nos collègues sont confrontés (climatiques, politiques et économiques, notamment). Ce stage répondait à une vraie demande puisque 19 bibliothécaires et archivistes de 7 pays différents se sont inscrits.

- Ensuite, travailler dans la langue des stagiaires, en l'occurrence le Français. En Afrique, trois grandes zones linguistiques (anglophone, francophone et lusophone) se partagent le continent. Il existe actuellement deux centres régionaux PAC, l'un en Afrique du Sud (anglophone), l'autre au Bénin (francophone). Des formations ont déjà été organisées en Afrique du Sud et en Namibie pour toute la zone anglophone, grâce à notre excellent collègue Johann Maree. Il n'y a pas de centre régional PAC en Afrique lusophone et il est peut-être temps d'en étudier la création : toutefois notre collègue du Portugal, Maria Luisa Cabral, a déjà dirigé plusieurs formations. Ce stage en français est donc une première alors qu'il existe 17 pays francophones en Afrique subsaharienne. Nous avons bénéficié localement du soutien de Francis Zogo, directeur du Centre PAC Bénin et de la Bibliothèque nationale.

- Ce stage s'est déroulé à l'Ecole du Patrimoine Africain à Porto-Novo, généralement impliquée dans des formations destinées aux musées, dont certains de nos participants étaient issus. Cela pour montrer un autre aspect marquant du stage : une rencontre entre archivistes, bibliothécaires et conservateurs de musées autour du thème de la conservation préventive.

Si le stage a selon moi bien fonctionné, c'est aussi parce qu'il ne s'agissait pas d'un enseignement à sens unique. Les échanges d'expériences furent nombreux et enrichissants, entre les stagiaires et avec les organisateurs. Surtout, nous souhaitons que cette première expérience marque le début d'une série de formations plus spécialisées : archives audiovisuelles, construction et développement durable. Il y a matière à bien d'autres thèmes de réflexion.

Plus d'information et de photos sur : http://www.ifla.org/VI/4/news/pac-preventive-training_jan-2009.htm

IFLA-PAC Cycle "Preservation and the four elements", 1st conference: "In and out Air Strategies. From Climate Change to Microclimate. Library, Archives and Museum Preservation Issues", March 5-6, 2009, Paris, France

On March 2009, 5th and 6th, the Bibliothèque nationale de France hosted a successful conference entitled: "In and out Air Strategies. From Climate Change to Microclimate. Library, Archives and Museum Preservation Issues".

This event was the first of a cycle of four which is organized by PAC Core activity in collaboration with other institutions, focusing on the four elements: Air, Water, Fire and Earth and how libraries and archives have to deal with them, obviously in terms of preservation.

The next conference will deal with Water and will be held in Prague (see the announcement p. 42).

The programme about Air was dense, beginning with a morning session dedicated to climate change. Robert Kandel pictured the global climate change, followed by specialists in cultural heritage buildings among whom Elizabeth English presented fascinating post-Katrina studies. The afternoon session was dedicated to indoor air quality: VOC was one of the main topics.



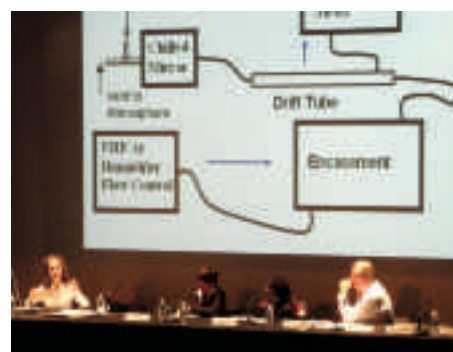
1. First session of the conference: Robert Kandel, keynote speaker, Carlota Grossi and Valérie Vesque-Jeancard (from left to right).
© Pascal Lafay / BnF

On Friday 6th, a large round table gathered experts dealing with air management issues, mainly concerning air-conditioning and natural ventilation.



2. Round Table (from left to right): Jean-Luc Bichet, introducing the Pierrefitte project, Tim Padfield, Thi Phuong Nguyen, France Saïe Beläisch and Isabelle Formont.

The last session offered the presentation of new tools and researches, particularly in the field of anoxia.



3. Anoxia session: Fenella France explaining anoxic encasements for select treasures, Nieves Valentin, Michèle Gunn and John de Lucy.



Photo de groupe à la fin du stage : de gauche à droite (1^{er} rang) : Raphaël Kompaore, Christiane Baryla, Oumar Diawara, Ngoné Sarr, Colette Gounou, Chantal Adjiman, Francis Marie-José Zogo, Atsu Yao Esabuè Odzukpa; deuxième rang : Léontine Aballo, Anne-Marie Odounharo, Sabi Tchagaffo, Rasmata Bounou, Ousmane Maman Idi, Gouro Venance Bahi; troisième rang : Abdourahmane Lô, Garbah Traore, Serigne Ndiaga Diaghate, Jean-Marie Arnoult, Mamadou Konoba Keita, Urbain Hadonou.

Thanks to the support of Airinspace and Stouls these two days allowed us to have the best experts on these topics, coming from USA, UK, Spain and France.

More than one hundred persons, coming from Europe, attended the sessions. The papers will be soon on line on our website (<http://www.ifla.org/VI/4/pac.htm>).

PAC CORE ACTIVITY

USA and CANADA

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PAC INTERNATIONAL FOCAL POINT AND REGIONAL CENTRE FOR WESTERN EUROPE, NORTH AFRICA AND MIDDLE EAST

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EASTERN EUROPE and THE CIS

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