Deliverable D14.1 Preservation Guide

General Guide to Audiovisual Preservation (Web Report)

Is this your problem?

If you have audiovisual media, it needs to be maintained – or you will lose it. This guide will show you how to:

- **conserve** old formats
- **digitise** for transfer to new formats
- create **digital file** formats
- use **digital restoration**
- use **mass storage**
- provide **electronic and web access**

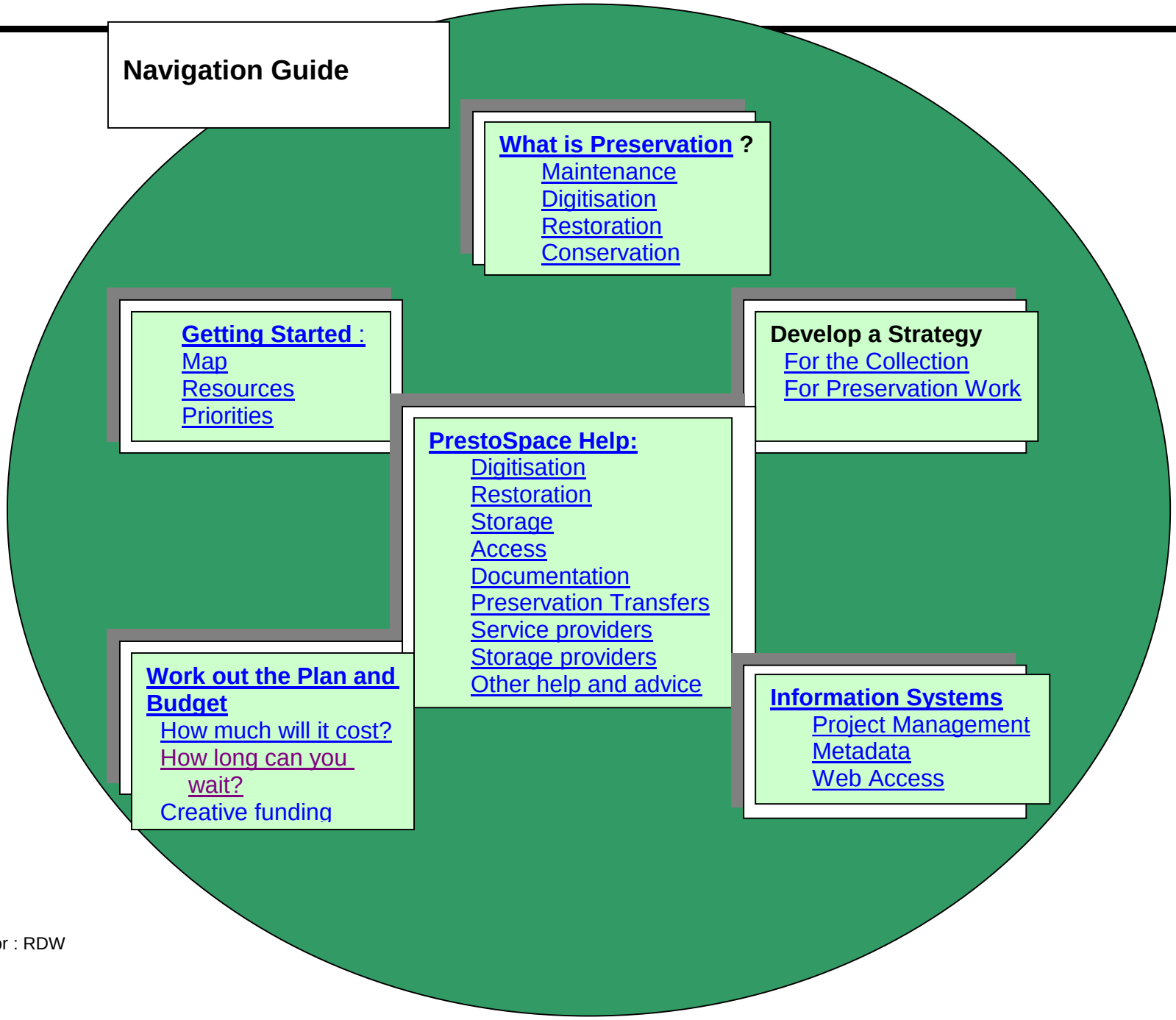
Those are just the technologies – some strategic thinking is also needed:

- at the institution level: where you are, where you want to get
- at the project level: how to run an efficient preservation project

The strategic issues raise other 'how to' issues, which this guide also covers:

- how to estimate costs – for specific projects and for long-term maintenance
- how to fund preservation

So, where to start? The navigation guide shows how we've organised our information. Each topic gives basic information, plus where to look for more if needed.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ABSTRACT A guide to audiovisual preservation, and to the PrestoSpace project. It cover how to: conserve old formats; digitise for transfer to new formats; create digital file formats; use digital restoration; use mass storage; provide electronic and web access

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1. What is preservation?

Here is the proposed CCAAA definition of audiovisual preservation:

> *Preservation is the totality of the steps necessary to ensure the permanent accessibility – forever - of an audiovisual document with the maximum integrity*[1]*.*

This is a better definition than most, because is says what preservation is **for**, rather than getting bogged down in preservation methodology. **Preservation is for "permanent accessibility** – forever". Also, preservation is everything that makes that permanent access possible: **preservation is "*the totality of the steps necessary".***

So why use the word *maintenance* on the home page: "If you have audiovisual media, it needs to be maintained"?

Institutions are used to accepting the need for maintenance in other areas, like buildings and computer systems. There is a need for institutions (and everyone else) responsible for audiovisual media to accept that preservation actions are a form of essential maintenance, and therefore just as deserving of a regular budget and associated activities – as for any other sort of maintenance.

1.1 Maintenance

We assume that computer systems or automobiles or buildings need maintenance. They need regular servicing or they develop faults. This guide will tend to use maintenance and preservation interchangeably, to promote the view that **for audiovisual materials, preservation is maintenance**. The reason for using the word maintenance is rhetorical: to promote the idea that preservation activity must be performed, and funded – and included in the standing maintenance functions of any organisation responsible for audiovisual material. Organisations that don't maintain their assets – that don't preserve their audiovisual content – are simply not being responsible.

Figure 1 - Lack of maintenance can leave you hanging:

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1.2 Digitisation

Many activities contribute to **"permanent accessibility** – forever". Just now, in the early years of the 21st century, we are at a stage where much audiovisual material from the 20th century is in analogue form – and most of the options for trying to obtain **"permanent accessibility** – forever" are digital options. So digitisation is of huge significance just now, as one of "*the steps necessary to ensure … permanent accessibility".*

There are many standards and guidelines concerning the technical details of digitisation [refs] and the reasons for digitising [refs; SAM Why Digitise]. There is also some controversy about whether digitisation is or is not preservation. For the purposes of this guide, the answer is clear. Digitisation is conversion of an analogue signal to digital – but digitisation may or may not be "*necessary to ensure … permanent accessibility".*

The rosetta stone is more that 2000 years old, and steps to ensure its *permanent accessibility* do not require digitisation – though digitisation and encoding of photographs for web access create a very useful improvement in access. Digitisation almost always supports measures to increase access (like encoding materials for web access) – but digitisation itself is not identical to preservation, as it is only a step that may or may not contribute to permanent access.

Having said all that, every category of audiovisual material except film in film archives (as opposed to film in broadcast archives) will probably have to digitise for preservation – because all non-digital options are disappearing. Wax cylinders dry and crumble[2], or become infested with mold.

Figure 3 - Wax cylinders dry and crumble

Figure 2 - Analogue audio technology (6mm tape equipment) is no longer being manufactured

Figure 4 - Shellac and vinyl discs sustain damage every time they are played

All analogue videotape formats are obsolescent, going the way of 6mm audiotape. Only two professional analogue formats are still in production (BetaSP, and the closely-related BetacamSX), and no professional equipment is in production – it's only available used.

Typical advert from the only method for purchasing professional analogue videotape equipment: bidding on the web!

Larger Picture

Starting bid

US $1,500.00
(Approximately £861.92)

Place Bid >

Time left:	**2 days 10 hours** 10-day listing, Ends 22-Feb-06 23:19:49 GMT
Start time:	12-Feb-06 23:19:49 GMT
History:	0 bids
Item location:	New York, New York United States
Post to:	Worldwide

So digitisation is far and away the primary method used to rescue content (at the sacrifice of the original carrier).

It is only “film for film’s sake” that is making significant use of conservation as a method of preservation.

Figure 5 - Cold Storage - Colour and black-and-white film

Storage: The National Archives Gatineau Preservation Centre (Canada)[3]

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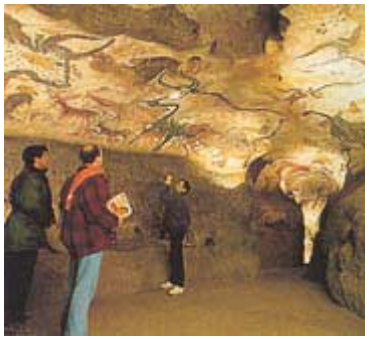
1.3 Conservation

Conservation is about hanging on to what you have, rather than transferring to something new. The fibreglass model of the Lescaux caves[4] are a copy that does not preserve essential features of the original, and so model does not preserve the original. But the copy allows the originals to be sealed off, a conservation measure to prolongue the life of the 20,000 year old originals. So the fibreglass copy does support preservation, by allowing conservation to proceed (by taking away the pressure for access).

Visit Lascaux II



Since the Lascaux Cave is closed to the public, a replica has been created at Montignac, 200 metres from the original cave, where two of the galleries have been reproduced: the Great Hall of the Bulls and the Painted Gallery.

Guided visit of approximately 40 minutes.

- **In season : open daily**
- **Out of season : open daily except Monday.**
- **Annual closing : January - Beginning of February.**

Information : Semitour Périgord - Tel : +33 5 53 05 65 65 - fax : +33 5 53 06 30 94

Film archives do exactly the same thing: they make access copies that in some cases (videotape, DVD) are in no way a replacement for the original – but they take pressure off the original, allowing it to be kept untouched in cold dry conditions. Generally film conservation is based on very cold storage at the appropriate humidity, and very limited use of masters.

Film archives also make high quality copies that are as close as technically possible to the originals. These copies can still be made by an analogue process, though the direction of technical change over the next decade may force film archives to change from analogue to digital methods for production of these 'new masters'.

Finally, film archives may use digitisation to produce a 'digital intermediate'[5] before finally producing a new analogue master. They do this in order to use digital technology for restoration – because there are many defects that can be removed digitally in ways that could not be attempted by analogue processing.

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1.4 Restoration

Conservation is about maintaining originals, and preservation is about ways to "*ensure ... permanent accessibility … with the maximum integrity".* So what is restoration? Surely if it changes a document, that affects integrity. This is an area where we could get lost in the metaphysics – and it would be far more productive and interesting to talk about what restoration can do, technically. Restoration can make old 'documents' look like new. However nobody may actually know what precisely a film did look like in its original projection – and improvements in projection and other technology means that some restorations literally are better than their originals.

One example is the Technicolor process, which used three separate films and three projectors built into one. There were always synchronisation and registration problems with this process – whereas the digitised films can be registered (aligned) with far higher precision than was originally possible. An example is the British Film Institute's restoration of Summer Madness[6]. Digital technology also provide mechanisms for recovering from colour fade that are far more flexible and accurate than for analogue methods.

Restoring parts of the Austrian film 'Opernball' with digital technology from PrestoSpace partner Joanneum Research[7].

[[I really need an example directly from Joanneum and not lifted from the web; on my screen, this processing appears to have taken a red film and turned it green]]

Leaving aside metaphysics about what is or is not preservation, modern restoration allows old media to be appreciated as though it were new media – and that was the original viewing and listening experience when these documents were created.

1.5 What this document covers, and doesn't cover

This guide is an introduction to the preservation of recorded sound and moving images. Throughout, it provides guides to further information.

The guide is not everything you need to know. Training in library science, practical experience using audiovisual equipment (backed up by some general engineering training) and a huge interest in and dedication to audiovisual media would be a good foundation for audiovisual preservation work – and knowledge of chemistry, physics, copyright law and building maintenance would also help. Finally the really important knowledge is around what audiovisual collections are for: who uses them, how they could be used more widely, their public and commercial value, their funding and business models.

A list of sources of training, advice and funding is in Appendix 10.1.

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2. Getting started

2.1 Where to start: cartography!

The very first thing is to know where you are: what's on the shelves. This information gives you a map of your audiovisual collection.

Do you know where you are, or is there *terra incognita* in your collection?

Figure 6 - Do you know where you are, or is there terra incognita in your collection?

How to make a map:

The map is not a catalogue. It is not about each individual item, but about each *type* of item. When a collection has been mapped into types, the preservation planning is then done for just these few types.

The first step is to decide *how* to divide the collection into types. The goal is preservation, so divide the collection into categories that have distinct preservation requirements.

The obvious place to start is with **physical formats**: the different kinds of media. Basically, you can start with dividing the collection according to the machine used to play an item. This would separate film from videotape, and separate U-Matic from Beta SP – but would not separate 5" reels of 6mm audio tape recordings from 10" reels. More detailed information is in PrestoSpace Deliverable D5.3 **Tools for automation of difficult media**.

Make a Map of your Collection

Divide the collection by physical formats, and collect the following information on each format:

- **age range**
- **storage history**
- **genre or value**
- **physical condition**

How old is each format? If you have materials from a range of ages (such as 1980 to 1985) then it would be very useful to know how many items from each year. If you have separate age ranges (such as audiotape from the 1950's, and also from the 1980's), then consider breaking up the physical format into two age types (or more if needed).

How has the material been stored? You may not know, or there may be various storage histories. Possibly some have been stored in an archive (with climate control) for most of their life, and others have been stored in home or office conditions for most of their life. Again, it would make sense to divide such a physical format into two storage types: controlled storage vs non-controlled storage.

Genre: So far, we haven't asked anything about the **content**! We're not interested in preserving blank material, so content matters. Under the term genre we create a set of types according to content. Typically types are: fiction or non-fiction; news, entertainment, documentary, drama. Again, the goal is to simplify and organise the decisions about preservation – and there is no need to preserve material of no value. So the label 'genre' is really for anything about the value of the content.

Once the types have been decided, **the next step is to evaluate the collection – get information on each type**.

1. Divide the whole collection into physical format types
2. Count the number of items in each format type (counting shelves is the usual method)
3. While counting shelves (step 2), estimate the age of each type – not the age of each item. Where necessary, you will already have subdivided the format type into age groups (ie 1950's audiotape and 1980's audiotape), so while counting shelves, estimate the number of items in each age group – for each format.

4. Another task while counting shelves is to estimate the storage history (life history). Again, where necessary, you will already have subdivided the format type by storage conditions as needed (eg items that have mainly been in controlled storage vs items that have mainly been in non-controlled storage).

So far, we've made a big assumption – that your material are already arranged on shelves divided according to physical format, age and storage history. If this is roughly true, the mapping becomes a shelf-counting exercise. If your materials are not divided this way – for instance if material of different ages are on the same shelves – then you need other ways to get the needed information. Possible age information is in your catalogue. Possibly *everything* you need to know for preservation is in your catalogue (in which case you are unique, because general experience is that preservation work exposes everything that isn't in the catalogue!).

If your shelves don't divide nicely by format, age and storage history (simultaneously), it may be necessary to count shelves more than once, separately for each relevant factor (like age or storage history).

5. Evaluate the content: divide by genre, or whatever types you are using that relate to content rather than to format, age and condition. This appraisal should be possible working strictly from the catalogue – though it has to be cross-referenced to the other information (format, age, storage history, condition) which again is where catalogues tend to be frustrating. Just possible the value or genre appraisal can also be done by 'shelf counting'.

Now comes the crucial part: physical condition. Here you will probably have to use sampling, because it would take far to much time and money to test every item. Alternatively you may have information already, from your own experience or from the experience of users of the collection. The basic task is to estimate the degree of playback difficulty, and the life expectancy, for each grouping. If possible, that means for every physical format, and for every division that you made according to age and storage history. Testing by genre shouldn't be relevant, because playback and life expectancy depend upon the physical factors, not on the content.

6. Test the physical condition. This is in two parts:
   - test whether an individual item plays first try; if it does not, record how much effort in hours (cleaning, baking, trying other equipment) is needed to make it play.
   - assess the general condition and life expectancy. For acetate-based materials there is a simple method to check the acetic acid level and predict life expectancy. That procedure is fully explained by the Kodak Image Permanence Institute [refs]. Other aspects of condition checking are covered on various websites [refs …].

The result of this exercise is a new description of your collection. It is largely a physical picture (except for the genre / value information), it is based on a small number of categories rather than on individual items, and it supports decisions about how to

proceed with preservation work – arranging the categories in a priority order (like the triage in an emergency ward) and then proceeding with preservation category by category – a divide and conquer approach.

Sample map:

Format	Age	Storage	Genre / value	Condition
16mm B&W film negatives	1950 to 1970	archive; uncirculated	Unique master material	good
16mm Ektachrome	1968 to 1982	office for first 5 yrs, then archive	News; high re-use	some colour fade
16mm B&W film prints	1950 to 1970	archive;	No permanent value: use negatives instead	fair: have been circulated
16m mag sound track	1950 to 1980	archive	Masters	**vinegar syndrome!**
16m mag sound track	1950 to 1980	archive	Duplicates; no permanent value	**vinegar syndrome!**

As you can see, this film collection has been divided into five parts for the purposes of preservation decisions. This data is based on a subset of the BBC's film holdings – and does not cover 35mm film or even16mm colour film apart from Ektachrome, and does not cover other complexities of film like "A-B rolls" and "internegs". So it is really a corner of the BBC film map, which has other maps for audio and video materials. As you can see, the format "16m mag sound track" was divided into two types: masters and dupes. This was recorded under genre, because the essential difference was one of value. A duplicate is of little value *providing there is a good master.*

What it shows, is that the 16mm B&W collection had to be divided into four parts: negatives, prints, sound track masters and sound track duplicates. For investment in preservation, we use the value table to decide to do nothing about prints and sound track copies – and concentrate on the other two categories. We then had to take immediate action on the vinegar syndrome materials, but have deferred further action on the B&W negatives. A detailed map would include life-expectancy estimates for the B&W negatives, showing how much time is available before further preservation actions are mandatory.

Further information:
A map is a simple idea, and a basic map is straightforward. When the categories (the countries on the map) are not clear, 'border disputes' can arise or categories may have to be subdivided. Since physical format and physical condition are the important features of a preservation map, technical knowledge is required. This technical knowledge isn't specifically "preservation knowledge", but preservation draws on such knowledge. Knowledge about formats, their players, their histories, and about

availability, operation and repair of equipment all are relevant. Format obsolescence is one reason for doing preservation work, and so there has to be knowledge about which formats are obsolete – and which will soon be obsolete.

Appendix 10.1 gives general sources of information, including professional organisations that provide training and conferences.

A useful article on 'preservation cartography' is: Dominique Saintville, INA (France) - *Preparation of legacy archives for digitisation: the INA migration plan*. September 2001 FIAT Conference [[locked FIAT reference ; public reference ?]]

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2.2 Muster your resources

The map of the collection divides the preservation territory into manageable pieces. Before planning a strategy for the collection and for the preservation work (one or more preservation projects), there is more basic information to gather. Now that there is a map for the collections, information is needed on what resources are available. The map will have identified preservation needs – so now the issue is preservation resources. This won't be shelf counting, but it could be head counting – and looking at finances.

The following are the basic categories to consider when gathering information on the ability of your archive to undertake preservation work. But – resources to do what? The collection map has only identified broad areas, which is not a preservation strategy or plan. One of the biggest choices in planning preservation is the decision about what work to do in-house, and what needs to be done under contract with a service provider.

There is a chicken and egg problem here. You don't need a lot of internal resources if a contractor does the work – but in order to make that decision you do need to know what could be attempted in-house.

Do you have what it takes?

In-house or contracted, it still takes:

- **staff**
- **equipment**
- **facilities**
- **logistics**
- **metadata**

- **staff:** technical staff to operate equipment. Cataloguing staff. Logistics staff to find and move media. Management. If you are a one-person archive, then your time has to stretch to all these activities.
- **equipment:**
  - **in-house** preservation work needs equipment: for cleaning old formats, for playing old formats, for writing / printing new formats. A key issue in videotape transfers is headlife: whether there are enough heads (or a reliable source of reconditioned heads) to play however many hundreds or thousands of hours of material to be transferred. For many archives

around the world, there is currently (2006) a worrying shortage of equipment for playback of audio DAT recordings.
    - **contracted** preservation work needs less equipment, but there still may be a need for players for checking as part of quality control.
- **facilities:** a place to do the work
- **logistics:** people and transport for finding and moving media as required, and (for transfers) for taking old material out of the collection and introducing new material
- **metadata:** maybe this should be at the top of the list. **An archive runs on its catalogue**. The mapping has already shown the importance of data about the collection. If the catalogue or database shows age, storage history, information about storage history -- and user or operator feedback about physical condition and quality – then mapping can be done just from the database itself, without walking around the shelves counting everything. Similarly, if material is bar-coded, and already identified to minimum cataloguing standards – the preservation work will progress efficiently. If not, then time, effort and material will be lost. Finally, if the metadata is missing or not up to standards [[ref FIAT minimum data list; Dublin core]] then completion of metadata should be an essential part of preservation work – which will add to the time and cost estimates.
- **existing funding:** thus guide would prefer to ask the question: “Can you afford NOT to preserve your collection?” However money is a key issue – and a surprisingly important issue is the accounting procedure. If your collection already has space and staff and equipment that are not fully occupied, a small amount of preservation work can be ‘kept off the books’ because the true costs are invisible (to the accounting process).

  This form of ‘preservation for free’ is attractive, but it can be a fatal attraction. If the work required exceeds the resources available, material will be lost. Further, it is hard to get financial approval for doing the required work at a certain price – if it is possible to do a fraction of that work effectively for free. The ‘invisible accounting’ limits the ability to fund

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2.3 Prioritise

Preservation has been defined in terms of permanent access, but that definition is the headline, not the detail. There is still more information to collect before starting planning, and that is information about preservation priorities for your collection. The following is a suggested list.

Your cruise ship is sinking, so what's most important?

- keeping the passengers happy
- getting a new engine
- keeping the hull watertight
- getting new passengers and going to new ports

- (keeping the passengers happy) **business priorities:** what do you do? Preservation decisions should be about purposes, not about media. Fundamentally, the object is **preserving access,** and so it is highly relevant to ask what kinds of access already take place. Who uses the collection, what parts do they use – and what would you the collection manager want to see for future access?
- (getting a new engine) **format obsolescence:** this is the area of technology priorities. Looking at the collection map, it should be pretty clear which areas have problems of format obsolescence.
- (keeping the hull watertight) **material degradation:** this is the area of physical priorities, the condition assessment part of the map. For both format obsolescence and material degradation, the priorities for preservation work change over time – so planning has to foresee the point at which obsolescence or degradation become very high priority.
- (getting new passengers and going to new ports) **new business opportunities:** what do you want to do? What could you be doing? This area could be essential, because it could be the prospect of new services that opens the door to new funding. Certainly it's a lot easier to raise funds when describing access and new forms of access – than when describing old material and forms of damage to old material.

An audiovisual collection isn't exactly a cruise ship, but audiovisual material is in danger of sinking. The cruise ship analogy does show how priorities change with circumstances. Getting a new hull isn't at all a priority until the old one is in danger of leaking – and if it does start leaking then keeping the water out doesn't just get a higher priority – it becomes the sole priority.

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3. Make a Collection Strategy

Preservation is certainly about staying afloat, but where are you going?

This guide is to preservation, not how to run your archive or predict the future. So this section isn't about how to make a strategy – it's a reminder that preservation is a strategic issue. Preservation is about keeping your cruise ship watertight – but with a new, streamlined hull you may be able to reach new ports, and provide new services.

Your long-term strategy must fit your particular circumstances, but the following issues will probably be important to all collections.

3.1 Long-term purpose of the preservation work

Where are you going, and can preservation work actually assist you – rather than being seen as just another burden on the budget? Audiovisual preservation is complex, but for most collections the technical future is clear, and has five parts:

- moving audio and video content from analogue carriers into digital files; this move allows mass-produced industry-standard storage to be used for audiovisual content – and means the end of all the special players and other technology previously required.
- holding those files on some form of mass storage
- reducing maintenance costs and simplifying maintenance procedures
- making low-quality access copies (CD, DVD)
- providing web access.

In summary, the 'big five' for archives and digital preservation processes are:

- digital files
- mass storage
- cheaper, better maintenance
- CD, DVD copies
- web access

More information for all of the above is on the PrestoSpace website.

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3.2 Access

Audiovisual material has always had access problems, technical, legal and procedural. The move into digital technology can remove many of the technical barriers to access, but the others are then more exposes – and may prove equally limiting. The most embarrassing consequence would be for access to be physically possible, only to find that the standard practices or even simply the habits of the collection managers are the real barrier.

So the basic questions are: are you ready for much wider access? Are there legal problems? Will staff work practices have to change?

- **Technical:** new technology allows audiovisual material to be viewed and auditioned from standard computer workstations. These cost much less than professional video equipment, although they are not cheaper than CD and VHS players that may already be in use for viewing. The move to digital files could make it affordable to expand in-house viewing facilities. For collections that serve a business, a first consequence of having digital files is the expectation by all staff that they should have instant access to the material. For collections that serve the public there will equal pressure for instant access. It will prove very hard to require pre-booking of material once it's been digitised – user's simply won't accept that the delay is reasonable.

- **Legal:** the main issue is providing access outside the walls of your collections. Most audiovisual collections have never provided such access, and many have words in their charter or other foundation documents, assuming that people will come to their institution for access – possibly even only for 'research access'. Copyright compliance may be seen to

require this attendance. As with pre-booking material, in an on-line world it will be increasingly hard to defend these policies and restrictions. They will be challenged. With the technical barrier removed, copyright law in general – and the wording of institutional charters in particular – will come under heavy attack. The barriers will certainly be shifted, if not dismantled.

Even if the law is not a problem, public access via the web may changes the nature and level of public access. Demand could surge. Different kinds of enquiry could arise, as access becomes more democratic and less exclusive. For web access, there will be no friendly librarian to guide people in the right direction, and exclude them from inappropriate material. Children will be able to see the whole website, and for war and holocaust and other materials this general access could be seen as inappropriate. Overall the collection access must be reconsidered, and planned. This all should be good news – collections are there to be used, not to lie dormant – but the pitfalls are there as well.

Figure 7 - Are you ready for public access?

- **Procedural:** online access means, basically, self-help. There is no member of staff to locate materials. Is your documentation adequate for use by the general public? What controls should there be on public access to meet legal and age-related requirements? Does your collection or institution want to serve the general public at all? Will staff see it as 'dumbing down', or as generating uninformed nuisance enquiries? Do staff prefer to deal with a few professional researchers on site, rather than the great unwashed loafing in the public access areas, and the even greater general population clogging up the web server with their unprofessional browsing? Most collections wish for greater access – but this is definitely an area where the consequences should be thought out, where all involved should 'be careful what they wish for'.

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3.3 Required changes to how the collection is managed

Planning for preservation of archive contents should fit into the bigger picture of plans for general development and management of the collection. The collection could continue its acquisition, curation, cataloguing, research and dissemination activities just as before – but how these operations are performed could all be revisited. Again, this guide is about preservation, not about everything to do with running an audiovisual collection – so here is just a short list of collection management activities that could be affected by preservation.

- **acquisition:** changes here include:
  - directly acquiring digital materials, perhaps electronically rather than by physical media
  - managing the *digital ingest*: getting new material into the digital system; ingest may mean digitisation or just format conversion
- **cataloguing:** if the material is online, so the cataloguing should be done online. If the cataloguing process includes anything that is written on paper and later typed in – or uses printed guides or other authority materials – it could perhaps save time and money and raise quality if the whole process were reconsidered as an end-to-end online workflow
- **curation:** this term means many things, but it often involves selection – for exhibits and special collections or any other special treatment. The selection can now be done online, which again could save time and money.
- **research:** with the catalogue and the content online, research strategies alter. It used to be effective to have extensive documentation, so that material pulled off the shelves and loaded into a player had a high probability of being just what was wanted. With online material, a researcher can – very quickly – check through key frames (thumbnails) and audio or video clips. The need for precision reduces, affecting both cataloguing and research.
- **dissemination:** this is probably the area of greatest potential change. The originals never leave storage, technical restrictions on access disappear, web technology can be used to access the collection. The whole effort to reach out from the collection to the community it serves should be reconsidered to make best use of the new technology and its possibilities.

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3.4 What the preservation project should contribute

As already indicated, preservation work could significantly affect **access**. As seen in the previous section, there is a relationship between digitised, online materials and all other work areas in a collection. The preservation strategy stage is a good time to look at all the required or possible changes and improvements that could be made to the operation of the collection – to the collection management – and ensure that the preservation strategy includes the work necessary to support those changes, where possible.

The activity that is central to most preservation projects is handling the individual media. Each item involved in the project will be taken off the shelf, examined, checked for correction of documentation, played (in most cases) and documented (or the

documentation will be corrected or improved, at least for many projects). All this is labour intensive, manual work. The point is, adding a step to the process – such as making two copies instead of one, or making a web-copy as well as a new master, or repackaging the originals – has a much lower *marginal cost* than would be the case if for a project to just make a web copy, or just repackage the originals.

A preservation project can be divided into two kinds of activity: logistics, and processing. Logistics refers to the task of getting material off the shelves, identified, into the hands of somebody doing some processing – and then back onto the shelves with update of the database to reflect any changes. This logistics work is kind of an overhead – it has to happen, but it doesn't do anything to improve preservation.

Processing is the activity that actually makes a change. The key idea is, adding a processing stage doesn't increase the logistics cost at all – it just has a *marginal cost* equal to the cost if the stage itself – and it gets its logistics for free.

All this means that the cheapest possible time to do ANYTHING that involves getting material off the shelf and into someone's hands, is during a preservation project. Each extra stage adds a marginal cost, but is saves the logistics cost that would be involved if the stage was done independently.

Recognition of the effective cost reduction involved in adding a stage to a preservation project can change decision making: an operation that was to expensive to do on its own, can become cost-effective when incorporated into a preservation plan.

Just a few examples of activities that could be included in a preservation project 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

So preservation work is expensive and time-consuming and demands resources – but it also opens opportunities: not just to change the archive content to include digital files and online materials, but also to do any number of other housekeeping and upgrading operations.

But housekeeping is the minor issue.. The major issue for preservation that involves digitisation is the potential for radically changing access. The whole access issue should have been thoroughly examined already, and the collection management

should agree a strategy for access and any other changes, as discussed above in section 3.3. The collection strategy should then feed into the preservation strategy, to make strategic use of the preservation project.

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3.5 Planning stages

For any sizeable project, the work will extend over years. This means that the strategy will need to extend over years also. That all gets a bit complicated. The obvious approach for dealing with the problem is to divide the archive strategy – and the preservation strategy – into stages. One typical set of stages is:

- immediate steps (1-2 years)
- mid-range steps (3-5 years)
- mid-range steps (beyond 5 years)

Strategic goal or activity	immediate (1-2 years)	mid-range (3-5 years)	mid-range (beyond 5 years)
Start collection website	**X**		
Put catalogue online	**X**		
Clear selected content for public website		**X**	
Align catalogue with standards for a common portal		**X**	
Have all digitised content available on website			**X**

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4. Make a Preservation Strategy

4.1 Selection: which material goes first?

There is a lot of information about selection. Most managed collections already have considerable experience of selection, including:

- Selection of the material coming into the collection
- Review of material at regular intervals, to decide about further retention

For a preservation process, the issue of selection begins with setting priorities. Generally there are the following major factors to consider:

- Value of the material
- Obsolescence of the format
- Condition and life expectancy

Fortunately, you've already made a map of the collection – so these factors have already been assessed, and the collection has been divided into broad categories. The work that remains is to make another sort of map: a preservation plan covering the entire time necessary to deal with all your preservation needs. This can range from a 6-month plan to transfer a small amount of material from an old to a new format, to a 400-year plan for the storage, restoration and re-mastering (onto film) of an entire film collection[8].

A preservation strategy is not a full preservation plan. For the strategy, the issue is sequence and timescale. All the elements in the preservation map that need attention are put in a priority sequence – and time information is added according to how long you want the work to last, or how long the funding lasts, or how long the material itself will last.

As a brief example, here's a possible strategy for the B&W plus Ektachrome film collection introduced in section 2.1:

Preservation Strategy: BBC 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

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4.2 Conservation: how to keep what you have

Conservation was defined in Section 1.3, and is a vital part of all preservation strategies. Even if the next step in a preservation plan is a transfer to new media, there has to be something left – ideally in pristine condition – to be transferred. Digitisation and transfer processes actual occupy a tiny proportion of the lifetime of an object. For the majority of the time, the main issue is conservation.

There are four main factors in a programme of conservation:

1. **Handling, packaging and shelving**
   This area is about the immediate environment of a physical item: what encloses it, what it sits on and how – and how humans manipulate it.
   - **Handling:** items should have protective packaging, and the item should be kept inside the packaging except when actually being used (played). Only trained staff should handle material when it is out of the packaging. Obviously, materials out of the archive should never be left exposed to the sun or chemical pollution, or to physical damage. This is easier said than done, which is why master copies should never leave the controlled area. There are detailed guides to the handling of wax cylinders, disc recordings (shellac and vinyl), open reel materials, audio and video cassettes – and of course film.
   - **Packaging**: Every item should be in a package, for prevention of physical damage and for environmental protection (from water damage and dust, and possibly also for humidity control. There are rather exotic techniques for putting material into sealed bags in a dry environment – to provide a low-humidity microenvironment. Such measures are not universally accepted (a sealed bag may accelerate vinegar syndrome, for instance). There are also standards for packaging, and so proper, approved packaging should be used – for ALL items in the collection. Packaging should be replaced when damaged (or when it goes rusty, as in film cans). The newer film storage packaging is plastic and cannot rust.
   - **Shelving:** Shelving doesn't have to be expensive and fancy, but it does have to of the right size for the material, and there needs to be enough of it! One of the major problems with shelving is when too much material is packed too tightly, and so items are damaged when pulled out or wedged in. Material should also be placed properly on the shelves. Usually this means upright, not flat – except for film – and oriented so that the packaging will not admit water coming from above (the usual direction to worry about, because if water comes from below that means the whole building is flooded and it doesn't matter which way up the cases are stacked).

2. **Environmental conditions** – and again there are three main factors
   - **Temperature control** In general, audiotape and videotape should be stored below 20° C, and the humidity should not exceed 40% relative humidity; detailed recommendations and standards on environmental conditions are in the **Where to get more information on conservation** section, just below. Film has more specialised requirements:
     - Nitrate film is flammable, and subject to special rules. Most countries have fire safety laws governing the handling and storage of nitrate film.
     - Film that is susceptible to colour fade needs to be kept at a very low temperature, around 0° C.
     - Film that is beginning to show vinegar syndrome needs to be kept away from other materials, as the acetic acid will damage everything in the collection if not stopped. It also needs storage a very low temperature, around 0° C, to slow down the chemical change until some remedial action can be taken (like making new masters, or digitising at very high quality).
   - **Humidity control** Dry is better than wet, as long as it isn't too dry. The recommendations suggest 30 to 40% relative humidity, for materials being stored at temperatures between roughly 10 and 20° C. At very low temperatures humidity is less an issue, and it is very difficult to maintain 40% relative humidity as temperature goes down toward zero, because the air's ability to hold water goes down as temperature goes down. So: as the temperature goes down, relative humidity goes up. This is why we get dew in the cool morning. What nobody should get, if at all possible, is dew in the archive! If material is kept cold, then some care must be taken when material goes into or out of 'cold storage', to minimise thermal stress and also to prevent formation of dew inside the packaging.
   - **Stability** of the environmental controls. Temperature and humidity are important, but a stable environment is equally important. When temperature changes, materials expand or shrink. Think films of acetate, wound hundreds of layers deep on a reel or cassette, can generate immense pressures which can distort and permanently damage the materials. The international standards for temperature and pressure also include standards for stability.

     Stability has two components: the sophistication of the environmental cools (the cooling and drying equipment) – and the time constant for change of the storage area. A big area, well insulated and with a lot of material in it will change temperature slowly, and so be easier to stabilise. A small room or a nearly empty room – with thin walls -- will heat up quickly once the air conditioning fails. It may be far more cost effective to improve insulation than to invest in sophisticated controls for the chiller and dehumidifier.

3. **Protecting the masters** – the basic idea for protecting masters is to minimise their use. Ideally, once in a great while, like 20 years, a master will be taken from storage and used to make a new sub-master. That doesn't mean that masters should be ignored for 20 years – condition checking should be done every year, but on a sampling basis.

Audio and videotape collections are have an advantage here, as they can make new sub-masters in-house for a relatively low cost – so they have no excuses for subjecting master material to risk by using it for regular playback, or loaning it out.

A proxy is just a copy. A plan for protecting masters by the use of proxies should have several layers

- Master material, used only to make sub-masters – at very long time intervals (like 20 years)
- Sub-masters, used to make distribution or access copies.
- Distribution and access copies – the daily working copies of the collection. These are replenished as needed by making new copies from the sub-master.

A sub-master should last 20 years – meaning it has to be able to make 20-years' worth of access copies before it is worn out. If the collection requires so many access copies that the sub-master wears out too soon, then a fourth layer could be added (something like Distribution Master) – so only distribution masters are made from sub-masters, and access copies (by now fourth generation) are made from the distribution master.

Many archives cheat – and once they have an access copy, they make another copy of that when it starts to wear out. This is clearly unsatisfactory, as the quality will go down and down and bring the collection into disrepute. Other archives regularly use master material for ordinary access. This practice should be avoided. It amounts to throwing the archive out the window – piece by piece. It is an unfortunate fact of life for analogue media that every use of an item causes at least a small degradation – and every use has a risk of very large degradation and damage. The digital world has solutions to this problem, but in the analogue **world the master copy should be protected as the absolute priority of the collection**.

4. **Condition monitoring** – Life-expectancy can be predicted, but predictions are generalities, and there is no substitute for direct examination of media. Unfortunately the only aspect of audiovisual media that is well developed for automatic monitoring is measurement of acetic acid level, for which there is a wealth of information and various forms of test materials [IPI references]. There are test strips that can be used on materials once they've been removed from their containers – and there are containers which incorporate indicators, for continuous monitoring. For large collections where use of such tests and containers would be very time consuming and expensive, it is perfectly feasible and (usually) satisfactory to use a sampling approach, and apply the test strip evaluation and the special containers to a statistically representative sample of the collection.

   There has been research on other methods of condition monitoring, and PrestoSpace is active in this area. One action is the report **D6.1 PM1 Report on video and audio tape degradation mechanisms** [ref].

Month 18 : D 6.1 PM1 Report on video and audio tape degradation mechanisms
Video tapes (and to a lesser extent audio tapes) are prone to a considerable number of degradations, which have a direct impact on the playability, on the risk incurred by the playback machine, and on the urgency for transfer. The two main types of degradation are the
tendency to head-clogging, and the 'sticky-shed syndrome', which tends to block the tape in the VTR. The causes of such degradation are currently unknown, even if hypothesis such as polymer hydrolysis and lubricant migration are the most advanced causes. A real study on what actually take place is required before trying to 1) detect and 2) correct the problem. This report will clearly demonstrate the different mechanisms that cause a tape to be unplayable, and propose ways for measuring the advance of these processes, and for curing these.

Month 30 : D 6.2 PM2 Manual tape condition assessment tool
There is currently no way of assessing the tape condition, other than attempting to play them, with the risk of damaging the VTR. Such tools exist for film (AD Strips). This Deliverable will be a tool for assessing the tape condition in the view of assessing, before transfer, the urgency, the difficulties to be expected, and selecting the tapes to be transferred first. This tool will be either be a handheld optical or chemical measurement tool, or passive sensitive detectors such as the ones used for film, that will measure the concentration of the chemical degradation markers.

Month 36 : D6.3 PM3 Automatic tape condition measurement tool
In addition to the manual tape condition assessment tool, an automatic tool that can be installed in a robot, or in a cleaning machine, will measure precisely the level and type of degradation of a video or audio tape, and recommend specific process such as baking if required. This tool will measure the status of the tape using physical methods (friction, residues measurements after cleaning), and/or measuring the concentration of chemical markers.

Where to get more information on conservation:

general references:

- http://www.clir.org/pubs/reports/pub54/ Van Bogart, Dr. John W.C. *Magnetic Tape Storage and Handling: A Guide for Libraries and Archives*. Washington, DC: The Commission on Preservation and Access and St. Paul, MN: National Media Laboratory, 1995.
- Audiovisual Archiving: Philosophy and Principles [PDF]. Ray Edmondson ; 2004. UNESCO
- http://unesdoc.unesco.org/images/0010/001096/109612eo.pdf "Audiovisual Archives: A Practical Reader" [PDF] Harrison, Helen P, 1997 ; UNESCO
- http://palimpsest.stanford.edu/ Conservation OnLine, Preservation Department of Stanford University Libraries
- www.ifla.org/VII/s35/pubs/avm-guidelines04.htm IFLA
- www.archives.gov/about/regulations/part-1232.html NARA ; 1232.22=Nitrocellulose (nitrate) film. 1232.26=Storage conditions.

National Film and Sound Archive, Australia

- Managing the Collection
- How to Care for Your Video
- How to Care for Your Audio

Wikipedia : en.wikipedia.org/wiki/Film_preservation

storage, handling and environmental conditions:

- *The Care and Handling of Recorded Sound Materials* Gilles St-Laurent, Music Division'National Library Of Canada January 1996 palimpsest.stanford.edu/byauth/st-laurent/care.html
- AES22-1997 (Reaffirmed 2003) AES recommended practice for audio preservation and restoration -- Storage and handling -- Storage of polyester-base magnetic tape [1997-12-11 printing]; AES Standards in Print
- http://palimpsest.stanford.edu/bytopic/environment/ Conservation OnLine, Preservation Department of Stanford University Libraries
- http://www.rit.edu/~661www1/sub_pages/acetguid.pdf IPI Storage Guide for Acetate Film

National Fire Protection Association

- Standard for the Storage and Handling of Cellulose Nitrate Motion Picture Film (NFPA 40)
- Standard for the Fire Protection of Storage (NFPA 230)

Society of Motion Picture and Television Engineers (SMPTE)

- *RP 131-2002: Storage of Motion-Picture Films*
- RP 103-1982 (Reaffirmed 1987), Care and Handling of Video Magnetic Recording Tape.

International Association of Sound and Audiovisual Archives (IASA)

Safeguarding of the Audio Heritage: Ethics, Principles and Preservation Strategy, IASA-TC 03, version 2, 2001.

International Standards Organization (ISO)

- ISO 18902:2001 Imaging Materials - Processed Photographic Films, Plates, and Papers - Filing Enclosures and Storage Containers
- ISO 18920:2000 Imaging Materials - Processed photographic reflection prints - Storage practices
- ISO 18923:2000 titled "Imaging materials -- Polyester-base magnetic tape -- Storage practices

International Federation of Film Archives (FIAF)

Technical Manual of the FIAF Preservation Commission

A user's manual on practical film and video preservation procedures containing articles in English and French.
FIAF 1993, 192p., 66.93 € or incl."Physical Characteristics of Early Films as Aid to Identification", 91.72 €

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4.3 Restoration

Restoration has also already been defined, in Section 1.4. Because audiovisual media are so easily damaged, restoration – which is usually an attempt to undo damage – is an important process in preservation. Restoration is a bit like a car body-shop: **a place to take something that's been banged up, where they can hammer out the dents and give it a respray.** The analogy is accurate, in the sense that a repaired car is never the same as an original, undamaged car – even if it looks the same.

Restoration has its successes and failures, as with car body repairs. There are defects (dents) that can be repaired, and others that can't (or not so well). Also there are differences in the technology used for restoration: some techniques work better on some defects than others, and some techniques are very specific. Therefore restoration is not a single process – you don't really send a film 'to be restored' – you send it into a complex process that will use many tools to do many things – all with varying degrees of success.

There are many tools that can be used for restoration – and terminology can be confusing. Here's a roadmap to the general types of restoration tool

1. **The basic technology of restoration:**

First of all, there are two classes of restoration technology:

- **analogue**
- **digital**

There are some processes that can still be done in the 'real world' (as contrasted with the world of ones and zeroes), and in fact done better. Most analogue media pick up dirt, and so cleaning is important both to preservation and to digitisation. Scratches on

the surface of a film can be made nearly invisible by coating the film with liquid when making a print – or when digitising – and so this 'wet-gate' transfer process is cheap, quick and effective.

It is the whole range of specific defects (apart from surface dirt and the sort of scratch that can be dealt with by wet-gate processing) that requires digital processing. Examples are:

- **Film:**
  - line scratch removal ***
  - dust/dirt/blotch removal ***
  - dye fading ***
  - image instability
  - grain ***
  - missing frames ***
  - noise ***
  - mold
- **Video:**
  - drop-outs ***
  - noise ***
  - 2 Inch scratch
  - stabilisation
  - line jitter (partially)
- **Audio:**
  - wow & flutter removal ***
  - cross modulation in optical films (the image affects the sound) ***
  - 24/96Hz sprocket buzz removal (for film soundtrack restoration) ***
  - over-softening of noise cancelling systems
  - hiss
  - compression
  - clicks
  - crackle
  - hum

Much work has been done on these defects, and there are dozens more. These are the most common – and **PrestoSpace is developing new or improved digital tools for most of them – all the ones marked with ***.** Fuller information on the PrestoSpace project's tools for tools for restoration is in Section 6.4.

How the tool is used: In general, a person uses a restoration tool – so the tools can be divided by how much the person does, and how much the tool does.

- **manual –** This is where the person points the tool at the defect, and so this is the slowest category.
- **automatic –** A tool of this sort may need a bit of manual set-up to start, but after that it runs all by itself. These tools are wonderful, and every audiovisual archivists dream. Unfortunately there aren't many! Some tools in audio are pretty effective running on their own (de-hissing and de-clicking if the clicks are all pretty much the same) – and colour fade on long sections where the fade is uniform.

- **mixed –** But most tools need some operator intervention either to set up a section or a frame, or to check results and re-set parameters. They differ from the purely manual tool in that a mixed tool will operate on multiple instances of a defect before again needing manual intervention – whereas a truly manual tool requires the operator to identify, individually, each and every blemish.

Speed of operation of the tool:

- **real time**
- **much slower than real time**

This is an important distinction for two reasons:

- a real-time restoration tool can be integrated with other real-time processes. For digitisation, which often happens in real time (because the players usually work in real time), a real-time restoration tool can then be used without adding anything to the overall time taken by the process. A common example is real-time de-clicking or de-hissing of audio signals when digitising 78 rpm (shellac) recordings.
- time means cost. Marvellous results can be obtained with modern restoration tools, but it can mean months of work to restore an hour of film.

2. History of restoration

Restoration is associated with the cinema, but in fact it is used for all audiovisual media. Cleaning has been a 'restoration process' for at least a century, and there are complex possibilities for altering an image during the photochemical processes of film developing and printing. These process have been used for decades to bring out contrast between light and dark, and to alter and enhance colours. These analogue and largely chemical processes, exclusively used for film work, can be highly effective but are also laborious, expensive and hard to predict and control – they are an art as much as a science.

The history of controlled, repeatable and precise restoration begins with digital technology, and this is a recent field. Film and video restoration builds on tools developed over decades (since the early satellite photos of the 1960's) for image restoration -- but with a major and vital difference. Film (and video) is about motion, and adding motion detection and prediction to a sequence of images opens a new dimension to processing possibilities – totally unavailable to image restoration where there only is a single image, and no motion.

Some landmarks in digital moving image restoration[9]:

- Ph.D. Thesis (on digital film restoration), Anil Kokaram, (Cambridge University,1993)
- Limelight (1995) – software for moving image restoration; a research project
- Hardware (digital signal processing chip = DSP) implementation, Nanyang University, Singapore (1996)
- DRS (Digital Restoration System), by MTI (1997)[10] – commercial software
- Textbook: ”Motion Picture Restoration“, A. C. Kokaram, (1998)
- Revival Digital by Nirvana Digital (1999)
- DIAMANT system (HS-Art Digital) (2002) – commercial software
- Archangel system (Snell & Wilcox) (2003) – commercial hardware

Meanwhile, digital processing was also being applied to audio – in this case starting in the 1960’s. Much of the early work was about getting speech out of noise for intelligence and forensic work (including processing the infamous “Watergate tapes” in the early 1970’s). All the work on improving intelligibility failed. The signal sounded better, but speech recognition scores on controlled trials did not improve – indicating that human processing still exceeded anything the machines could do.

In the 1980’s, it was realised that success could be dragged from the embers of failure – and that a ‘better sound’ was just what was needed for many situations, and for the recording, broadcasting and cinema industries in particular.

Early work was again at Cambridge University (1980’s) under Professors Peter Rayner and Simon Godsill[11] – and early successes included work on recording of the British Library Sound Archive, under their sponsorship. The work was so successful that it became a commercial company which now has a range of hardware and software products and services: Cedar Audio Ltd.

Systems for audio restoration:
This is just a short list is the major companies specialising in audio restoration.

- Cedar Audio Ltd. (1988)
- Sonic Solutions (1980’s)
- Cube-Tec Audio Cube (1996) and Quadriga

3. Notable examples of film restoration

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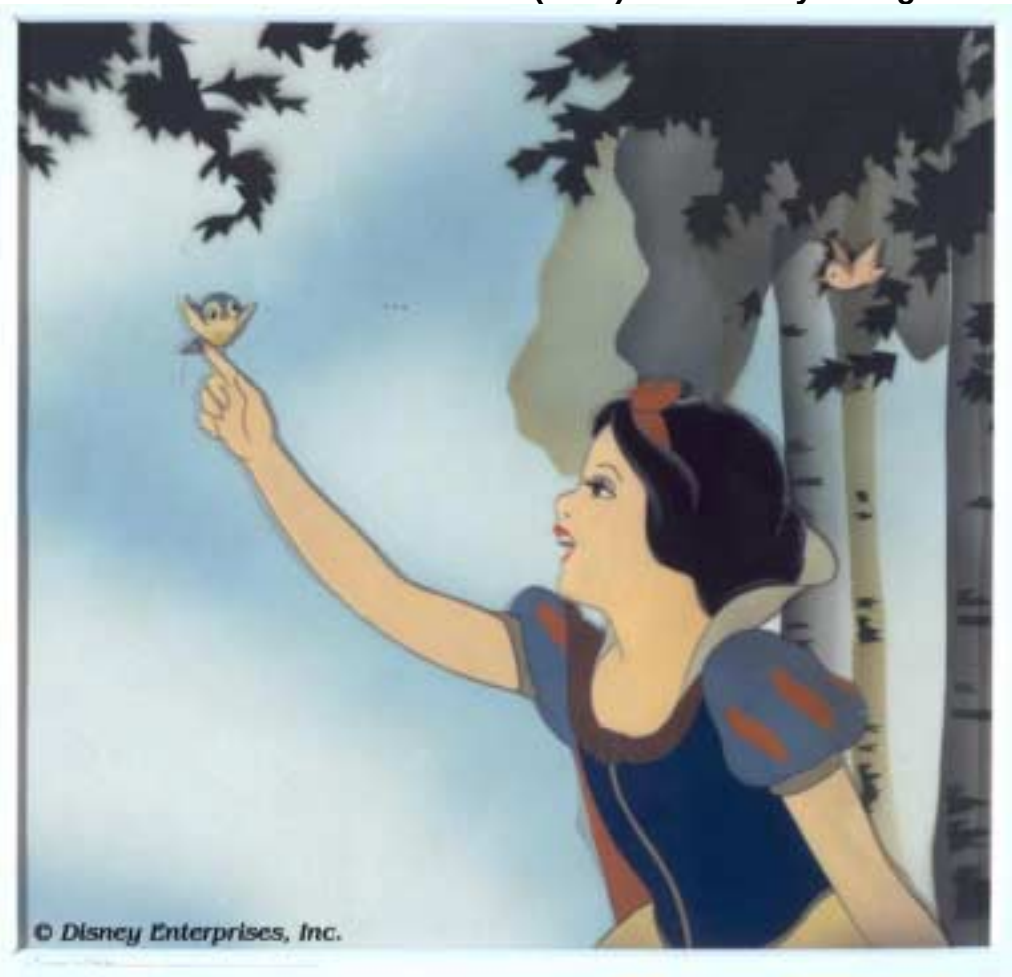
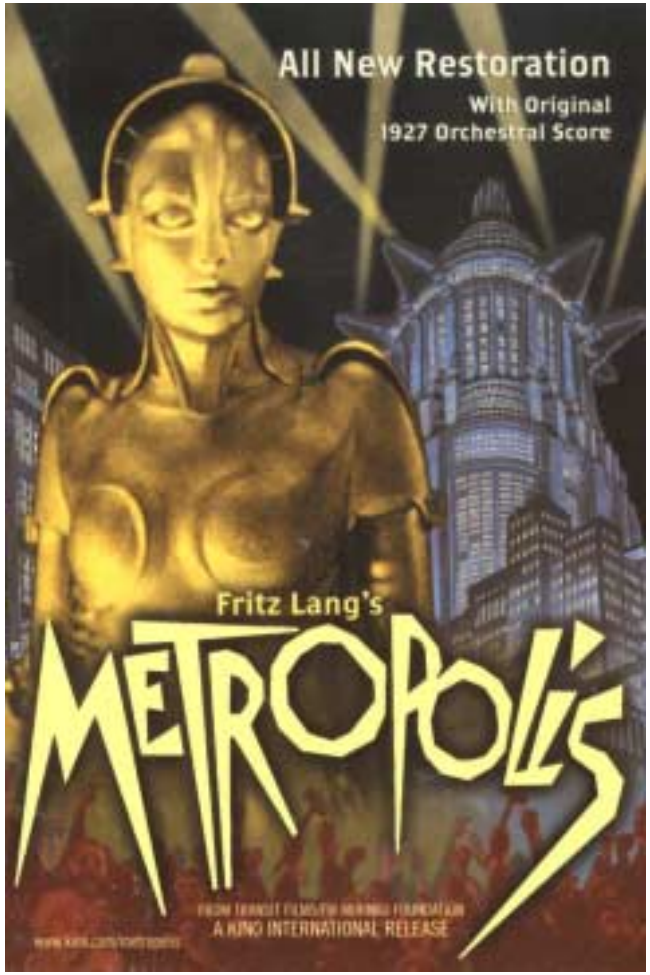
Snow White and the Seven Dwarfs (1992)[12] – an early all-digital restoration[13]



Opernball (Opera Ball) (1998)[14] – EC project FRAME, using Joanneum and other technologies



Metropolis (2001)[15] – A much larger project than Opernball, which revived commercial distribution[16] of this classic

4. How it works

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Briefly, the existing technology for media restoration is a combination of software and hardware. The standard approach to restoration differs according to media, as follow:

Audio

- Software based
- much of the software runs in realtime, at least at the professional level
- software uses a ”plug-in” (modular) structure, so functions can be separately selected
- the operation is file to file: the software operates on an input file, and makes a new output file

Video

- Hardware based
- working is standard definition and in high definition
- running in real time
- no plug-ins; instead of modules manufacturers sell specific hardware
- SDI to SDI (real time serial digital signal at input and output); SDI will directly connect to digital video tape recorders and other broadcast equipment

Film

- Software based
- working is standard definition and in high definition, but going beyond that to 2k, 3k and higher numbers of lines per frame
- non-real time
- modular plug-ins
- file to file operation, as with audio
- the file format(s) for digital video are not standardised (yet)

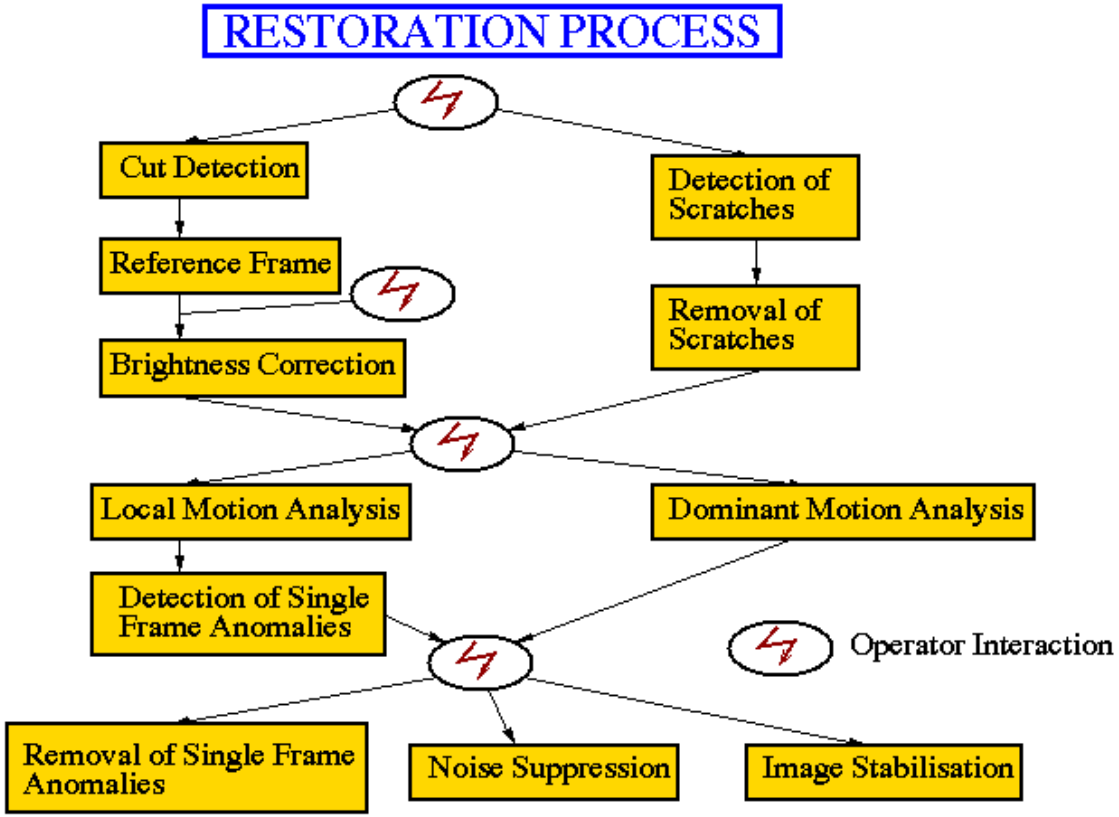

Figure 8 - a typical sequence of operations in film restoration

5. Costs

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The good news is that restoration software has come down in price, although as institutions become seriously involved they tend to want more computing power behind the software. Hardware reduces in price also, but again that reduction just feeds a desire to increase capacity and throughput. The following is the author's 'rough guide' to costs of restoration:

- **entry level**: now under 10k € (for the software; find your own hardware)
- **professional:** 10k to 100k € for software and hardware to support a small team engaged in restoration
- **high-end:** 100k to 1 M € -- for the sort or restoration facility that could compete globally for commercial restoration work

In general, restoration hardware is about 10 times the price of software – and runs 10 to 100 times as fast. One of the most significant developments regarding software is that the ten-fold reduction in cost (compared to hardware) allows many more collections and other interested parties to begin to do restoration work. As computer costs drop, the software approach will become increasingly powerful and fast. It is hard to see how a special purpose restoration hardware will remain competitive, except for niche applications that absolutely demand real-time processing.

The above prices are the cost of the kit. What about the cost of the work itself? Because the work is labour intensive, the cost of the restoration is dominated by the labour cost. In a research environment, with graduate student labour, restoration costs translates into the salary of the student – and a student can do about one restoration project (feature-length film) per year!

There are rumours that the Disney restoration of Snow White cost around $1.5 million in 1992[17]. A major restoration for film involves many physical elements (bits and pieces of extant negative and prints, to get the best originals for each frame), various analogue and chemical processes (cleaning, scanning, printing), all the digital work – and then restoring (for a sound film) or re-making (for a silent film) the sound track. The conclusion is that feature film restoration is a major enterprise – though it should be remembered that the individual graduate student, researcher or dedicated archivist can use entry-level software on a reasonable sized personal computer and do significant work.

Finally, just because restoration is labour intensive, commercial work has been globalises – and companies in Hollywood are sending hard drives of digitised film (and soon will be using very high speed network connections) to India, where labour costs per month are roughly equal to cost per hour for film restoration in major commercial facilities in London[18].

6. how restoration fits into a preservation strategy

We have used the CCAAA definition of preservation – **permanent accessibility.** Restoration is very much about accessibility in the wide sense: access to what the people who created the film or video or sound recording made at that time. So restoration is about getting back to the original – removing the affects of time and handling. Therefore whenever an audiovisual item has become **noticeably impaired,** there is a role for restoration.

Ideally, restoration would be applied in every case of impairment, at the time that an item was being replayed – for transfer to new media or just for checking. Unfortunately the ideal is unaffordable, so the usual route is to perform 'restoration on demand' – at the time that an item from a collection is taken out (rather than when a new copy is created).

One important element of the PrestoSpace project is to link digitisation with restoration. At the time that an audiovisual item is being digitised, information should be gathered about whatever defects can be detected. This information forms part of **preservation technical metadata.** The result of this approach is two benefits:

- when a digitised item is accessed, there will be a report describing its technical condition. The user or collection manager will know, from the metadata, the amount of impairment and damage that has been found on the item – and hence its suitability for various forms of re-use.
- when restoration work is done, there is already a map (yes, another map) of just where the damage is, and what it is. The automatic identification of defects during digitisation eliminates the need to do all that work during restoration.

PrestoSpace has defined the measurements that are important for restoration, and can be efficiently created during digitisation. These are documented in **D8.3 RST3 Restoration Metadata** [ref]**.** An important part of the definition of a PrestoSpace preservation factory is an approach to digitisation that will be capable of producing restoration metadata.

More information on restoration:

- Systematic list of problems: http://brava.ina.fr/brava_public_impairments_list.en.html
- Images, examples: http://ourworld.compuserve.com/homepages/PeterFinklestone/2inchQuad.htm
- Prices audio restoration: http://www.denoise.com/restarch_restoration.cfm

4.4 Digitisation

Digitisation is so important that it causes a problem – it overshadows other vital preservation requirements. Conservation and documentation are equally vital, but easier to overlook. Restoration is the magic wand that relies on digitisation, but involves for more complex (and expensive) processes.

For a preservation plan, there are two major uses of digitisation:

- production of new (digital) masters
- production of digital access copies

For audio and video, moving from analogue to digital masters is a significant step, which in the long run should make maintenance cheaper and easier – because it's easier to copy files than to copy physical media.

1. **Why digitise?** The time, effort and cost involved in digitising an audio visual archive is a major investment. It's quite reasonable to ask for strong and compelling reasons to undertake this transformation. PrestoSpace have an online tutorial[19] **Why Digitise** exploring the reasons for making this move from discrete and/or analogue storage, into a digital mass storage system. The tutorial breaks the reasons down into those sections which PrestoSpace addressing:
    - Preservation
    - Restoration
    - Metadata Access and Delivery
    - Storage and Archive Management.

2. **How?** There are now many sources of information on the process of digitisation, though this is a skilled technical process and one of the best options is to use a professional service provider. An excellent overview of both audio digitisation and the whole issue of mass storage has been provided by IASA in their publication IASA TC-04 Guidelines on the Production and Preservation of Digital Objects[20].

    Technical professionals – in archives and other collections or in the services industry – can get advanced digitisation technology from PrestoSpace, as described in Section 6.1 (PRE deliverables).

    For anyone planning their own digitisation work, it is impossible to overestimate the importance of technical standards and quality. Digitisation will only happen once, and any loss of quality is permanent.

Beyond PrestoSpace, other online sources of information about digitisation are:
US Library of Congress Digital Audio-Visual Preservation Prototyping Projects http://www.loc.gov/rr/mopic/avprot/avprhome.html
TAPE Training for Audiovisual Preservation in Europe www.tape-online.net/
Moving Image Collections (MIC) Preservation Portal http://mic.imtc.gatech.edu/preservationists_portal/presv_index.htm
Conservation OnLine: video preservation: http://palimpsest.stanford.edu/bytopic/video/
Conservation OnLine: audio preservation: http://palimpsest.stanford.edu/bytopic/audio/
Conservation OnLine: film preservation: http://palimpsest.stanford.edu/bytopic/motion-pictures/
National Film and Sound Archive (Australia):
http://www.screensound.gov.au/Screensound/Screenso.nsf/HeadingPagesDisplay/Preservation?OpenDocument

3. **Digital media and storage** After digitisation, there are lots of ones and zeroes sitting somewhere? How they are stored, and the implications for access and maintenance, are the subject of much further PrestoSpace information, introduced by another online tutorial: Selecting Your Storage Solution.

4. **Access** There can be many version of an item in an audiovisual collections, and in a digital world this situation becomes more rather than less complex. The overall preservation strategy should include specification of what master quality is kept, and what access formats (probably at lower quality) are derived.

Very roughly, there are three significant qualities (encodings) to be distinguished:

- **best**: master: digitised at a level sufficient to capture the content of an analogue original.
- **good:** online viewing / listening: master quality implies large files which may be slow to move around, so for general in-house access it may be effective to have a viewing quality
- **web:** poor quality, but adequate for web access. Web quality is generally considered poor when compared to proper masters, though with modern encoding and broadband connections, VHS quality is available from the web for streaming (immediate access), and DVD quality is available (if you can wait) for downloads (file transfer from website to local computer).

The following table gives datarates and quality levels for common digital video files and digital videotape. Rec 601 is the engineering standard for full-quality (no data reduction) standard definition digital video[21].

Compression	Datarate,	Quality	Comment

Type	**Mb/s**		
No compression	270	Master	Rec 601, standard def TV
Lossless JPEG2000	Approx 90	Master	Rec 601, standard def TV
MPEG-1	1.2	VHS	Wide internet use
MPEG-2	5	DVD	Used on DVD and digital TV broadcasting (DVB)
MPEG-4	0.5	VHS	Will replace earlier MPEGs
MPEG-4 AVC	8	HDTV	Will be used on HD DVDs, and possibly on HD TV
DVX	0.5	Near VHS	Wide internet use
Digibeta	80	Near Master	Nearly full quality
DV, DVCAM	25	« Pro-sumer »	Pictures near digibeta quality, quality suffers on repeated decode-encode
DVC-PRO 50	50	Near Master	Pictures near digibeta quality, quality suffers on repeated decode-encode

Mb/s = megabits per second; typical broadband internet connections are 1 Mb/s.

PrestoSpace information on access is available from the ‘Metadata, Access and Delivery’ area of the project, which is discussed in section 6.6.

4.5 Documentation

An archive travels on its catalogue. Documentation enables access. Without documentation material cannot be found, and so material will not be used. Any collection that intends to be of use – to a business or to the public at large – can only achieve its potential if adequately documented. This fact has been known since the Library of Alexandria, and digitisation only emphasises that fact. With an analogue collection there was still some chance of 'walking around the shelves' to look for something. In the digital world – certainly in the mass storage world – there are no shelves, and documentation is all.

A preservation strategy should include documentation, and the following steps are suggested:

1. Survey (map) of existing documentation: as with the physical collections, it is important to know the status of the documentation. If there are gaps, they will have to be filled as part of digitisation – because an undocumented digital file will be completely pointless and unreachable.

2. Define goals for the documentation system: documentation gaps need to be filled, but there may be other goals:

adopting one standard for all documentation; digitisation tends to centralise content, especially if a mass storage approach to digitisation is used. It becomes increasingly inefficient and expensive to have multiple catalogues attempting to point to various kinds of data files – which historically may have distinct physical media with distinct catalogues. As the distinct physical media disappear, so do all arguments supporting distinct catalogues, or methods of cataloguing.

getting all documentation into a computer database; because manual (card catalogue) access to a file-based system is extremely awkward, and manual access via the web is impossible.

3. Documentation to support access: access to audiovisual material requires text, and will continue to do so. The collection strategy should already have defined goals for access, so when considering documentation the issue is making sure the documentation supports the planned access. For instance, public access probably implies a need for simple categories or key-words, and a free-text search engine to back up subject-based retrieval. The best guidance for working out how to use documentation to support and achieve desired access, is to look at successful sites.

PrestoSpace has done a review of professional systems for audiovisual documentation, and of international standards. This Analysis of Audiovisual Documentation is available on the PrestoSpace website[22].

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5. Making a Preservation Plan – and Budget

5.1 What to do

Once you have a map of the collection, and a strategy for the collection, the preservation strategy is not complicated. There are really only two options:

- Items will be conserved
- if conservation is not possible or useful then they will be transferred to something new

The difficulties are in the detail. The requirements for conservation have been given above, in Section 4.2

For items that have passed beyond the conservation stage, there are two areas requiring decisions:

- when to take action
- what specific action to take

A preservation strategy is simply a schedule of actions. Every type of content in your *collection map* should have a place in the schedule, showing what action is being taken – and when the decision will be reviewed.

So what is a preservation plan? The plan adds the specifics. The strategy may say 'conserve another 10 years and then review', or it may say 'make new master copy'. The strategy may even say 'make new *digital* master copy'. But it is the plan that say exactly what the conservation method will be – and the real complication comes in saying what the exact method will be for making a new master.

The basic decision about a new master copy is analogue or digital. The official PrestoSpace advice is that, except for film, there is now NO reason to ever make an analogue copy of audio or video. It will cost more -- and give less benefit – than digitising.

In consequence, the main new information in a preservation plan (as compared with a strategy) is:

- the exact specification of the digital object that will be made
- who will make it
- how long the process will take

For a large project, there is a lot more detail in a plan – because a large collection cannot send all its material out for transfers at one time. So a large collection breaks the digitisation into phases, and the plan should define the phases. For instance, a

collection of U-Matic tapes covering a 10-year age range might be done in groups of one year's worth of tapes at a time, working from the oldest to the youngest.

Here is the (hypothetical) strategy for the BBC 16mm film collection previously discussed, followed by a simple preservation plan:

Preservation Strategy: BBC 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

Preservation Plan: BBC 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 chec each CD. Selec to-end checking. in-house.
16m mag sound track - duplicates			X	X	
16mm Ektachrome	Conservation for 2 more years; 10° C; 35% rh	In House	X	X	
16mm B&W film negatives	Conservation for 5 more years; 10° C; 40% rh	In House	X	X	
16mm B&W film prints	Conservation for 5 more years; 17° C; 35% rh	In House	X	X	

Of course there are a lot more decisions to be made for actual running of the transfers. It is easy to write 'batching: monthly basis'. In an actual project, the entire collection of magnetic sound tracks has to be identified [in the catalogue if possible], identified on the shelves, segregated immediately to a new room (because of the threat of contamination), and then a method devised for sending the right amounts of material each month to each contractor. The checking has to be decided upon and organised. Service level agreements with the contractor are needed – and these agreements have to be monitored and managed. That's all important, but it's not part of the headline *preservation plan*. Rather, all those considerations constitute the detail that makes the plan work.

A lot of detail is about metadata: how the items are to be found, and how the 'outcome' items are to be labelled and identified. Ideally every physical new item will have an integral bar code and packaging with a bar code – and the bar codes will agree with the catalogue for the collection. **One of the easiest ways to save time and money in any large project is to use bar codes for identification of items**. Trained audio and video specialists can get on with their specialised work in an efficient manner if bar codes are used. If the metadata and physical identification is not thought through and automated, up to half (we know; we've been there) of a trained specialist's time can be expended on purely logistical issues of identifying and re-labelling of items. **Quality**

control also suffers with manual identification, as labels can get mixed up, words get misspelled and a range of other human errors can creep into the process.

A vital preservation decision is: what to migrate onto (what new format to use). All the information that PrestoSpace can supply to help make the decision has already been presented in the digitisation section 4.4. However PrestoSpace has two other kinds of help:

- specific technology for advancing the state-of-the-art in digitisation, section 6.1
- the *preservation factory*: a concept adopted by service providers to provide audiovisual collections with affordable services at archive quality (section 9)

5.2 How much it will cost

PrestoSpace has a detailed model for estimating costs of a transfer project [ref D13.1 and D13.2] – but at the heart of the model is a per-item or per-hour contractor cost. Although the model has a default value, the user really should update this value, based on negotiation with a service provider.

If transfers are being done in-house, there is no service provider to ask. However cost estimation for in-house projects are filled with uncertainties, because of the many different ways that collections count their costs.

The best way to estimate costs is to do a pilot project, and work out the average time taken for two cases:

- a simple transfer, where nothing goes wrong
- a problem transfer, where extra steps are needed to make the transfer work

The other key item of information required by the model is an estimate of the percentage of the material that will have a problem. Typically problem material costs something like four times as much (takes four times as long) as non-problem material. This ratio means that for a project with 20% problem material, half the budget goes on the problem 20%, and the other half goes on the simple 80%. If money is insufficient to pay for everything that a collection needs (and all archives have budget problems), then it makes sense to get 80% of the archive transferred rather than 20%, by concentrating on the straightforward material.

This is the principal of triage, and it is a cornerstone of the preservation factory. If resources are limited, as in doctors at a disaster, triage is used to get the best result from the limited resources. For archives, resources are always limited, and triage is always preferable to simply allowing chance to determine what is saved and what isn't.

It is then up to the user of the PrestoSpace model to convert from time to cost, and use the model to estimate full project costs.

PrestoSpace is working in two areas to support triage decisions. The project is collecting data on batches of media, to build a database of information on media which is likely to cause problems. The project is also developing practical methods for making condition assessment – a method to detect deterioration before it reaches the stage where it causes playback problems . Clearly this is a very useful extension to the triage process: first save the material which can still play (first time) but won't play so well for much longer.

[ref to D13.1 and D13.2]

The PrestoSpace cost model also includes acquisition of new technology: mass storage for holding electronic files – and cost of making web-quality versions as well. The only significant aspect of "preservation by transfer to digital format" that is not covered in the model is cataloguing. However cataloguing is very much a part of the overall PrestoSpace concept – including important new technology for automatic generation of metadata for certain materials [MAD deliverable]

5.3 How long to wait

There are three reasons for moving from old to new media:

- the condition of the current material forces action: this could be physical damage, or chemical processes.
- the format is no longer convenient to use; it is obsolete or soon will be obsolete
- there is a pressing case for adopting digital technology, to improve services and reduce maintenance costs

Under the section on conservation, information and references were given on predicting life expectancy of common media. Typically video formats will physically outlast their "format life", and formats in videotape now have a useful life (before being replaced by newer formats) of around 10 years. Recent audio formats have had about a 20 year life. However both audio and video are moving to an era where the whole concept of physical format is being replaced by electronic files. More commercial music is now being distributed by files than by any other method[23].

Professional video is also moving to file formats. Domestic video continues to use optical media (DVD) and will continue to do so for at least twenty years. Existing DVDs are being replaced by new, high-capacity DVDs – but there is a currently a 'format war' between two competing, incompatible version of high-capacity DVD[24].

The conclusion is that current media may last for more 20 more years or more, but format obsolescence and the advantages of digital technology are pushing ALL collections to adopt digital technology – even film, where digital restoration and digital access copies (DVDs) are the motivations.

Twenty years is not a long time on archive scales, so effectively all audiovisual collections are now faced with the necessity or desirability of digitisation projects.

5.4 Creative approaches to funding

The basic PrestoSpace message around funding is that “access attracts support” – but it is up to the individual collection to turn that generalisation into something specifically useful – and profitable – for themselves. PrestoSpace has concentrated on reducing the cost of preservation processes (digitisation, metadata) because by and large we are engineers, not financial advisors. However we hope in the final stages of PrestoSpace to collect useful information on funding sources and possibilities, and put the information on the project website.

However there are two aspects of funding that relate directly to technology:

- **Incremental funding**- The cost of mass storage, whether for hard discs or for data tape, has been dropping sharply (reducing by 50% every 18 to 24 months) and that trend has continued for twenty years, so it should continue for at least another ten and probably another twenty years. This means that storage should be bought as late as possible, and it makes sense to but storage in small rather than large quantities, and only when needed. It is pointless getting a 20% quantity discount now, if a 50% reduction is available just by waiting 18 months.

  The essential condition for benefiting from these cost reductions is that technology bought in bits and pieces rather than all at once has to fit together. This isn’t an obstacle, just a consideration.

- **Giving away access**- The idea here is that publicity is good for a collection. If there are commercial possibilities for a collection, conventional thinking was that you shouldn’t give away anything that you can sell. But even conventional thinking would agree that you have a better chance of selling something if you have a widely-distributed catalogue – with nice pictures. Putting archive material on the web should be thought (by commercial collections) of as a catalogue, not as a lost sale. There are now statistics from collections which have ‘given away’ web versions of their content, showing dramatic increases in business resulting from the simple fact that the free material on the web was effective advertising **[Prelinger ref]**.

5.5 Getting best value for money: the factory approach

Section 9 shows how to make preservation transfer budgets stretch twice as far – or even four times as far in some cases (when there is a sufficient amount of material of the same technical format and of similar physical condition). Appendix 10.2 gives information on providers of preservation services.

5.6 Benchmark costs

(TO BE UPDATED)

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6. PrestoSpace support for Using New Technology

This section doesn't explain preservation – that has been done in the previous sections. The purpose of the following material is to have, in one place, an index of the PrestoSpace work that either explains or develops digital technology relevant to audiovisual collections.

6.1 Digitisation: [PRE deliverables]

Month 12 :D 5.1 PAU1 Automated Video Cassette Preservation tool
The Automated Video Cassette Preservation tool will run unsupervised as much as possible, night and day, so that it can transfer 24h/24 massive amounts of videotapes. The system will be autonomous, in the sense it will transfer, without operator intervention, programmes stored on cassettes, detect when the transfer quality is lower than expected, and take appropriate actions (re-clean, apply specific processes, try another VTR... and reject if necessary). The transferred programmes will be stored on videotapes, and/or datafiles .The system will store information on the position of drop-outs, RF level, and other relevant information, in the view of preparing possible subsequent restoration.

Month 18 : D 5.3 PAU3 Tools for Automation of Difficult Media
This Report will identify and document Best Practise solutions and Automation tools for digital preservation of massive amounts of 'difficult media' to 'difficult' media : film rolls, open reel video, audio (SepMag and 1/4 Inch, 78rpm and vinyl disks)... Some Automation tools may be identified as additional (non-funded) deliverables to the Project.

Month 24: D 5.2 PAU2 Automated Audio Cassette Preservation tool
The Automated Audio Cassette Preservation tool will run unsupervised as much as possible, night and day, so that it can transfer 24h/24 massive amounts of audio tapes. It will transfer, without operator intervention, programmes stored on cassettes, clean the tapes, detect and reject the tapes that are likely to fail or damage the player, (optionally apply suitable process to these cassettes), automatically detect the end of programmes, detect when the transfer quality is lower than expected, and take appropriate actions (re-clean, apply specific processes, try another player... and reject if necessary). The transferred programmes will be stored on datafiles. The system will store, as much as possible, information on the position of problems, and other relevant information, in the view of preparing possible subsequent restoration.

Month 24 : D4.2. PPB2 Improved 1/4 Inch audio tape player

The improved 1/4 Inch audio tape player will used advanced multi-track reading mechanisms, and signal processing tools that will reconstruct automatically from the tape signal the number and location of tracks, compensate on-the-fly azimuth error or fluctuations, and drop-outs. This will provide, without fine tuning effort, the best playback quality.

Month 30 : D4.1: PPB1 Fast, affordable datacine
The fast, affordable datacine will be robust to archive film conditions (spliced originals, tape and cement splices, punched edges, damaged perforations, curling). This datacine will run as unsupervised as possible, and transfer the films loaded by an operator to a temporary disk buffer, at a resolution compatible with archive requirement (to be confirmed : 2K, 12 bits RGB), and offer exports to several kinds of media : SDI and HD-SDI, compressed file formats will be determined by the User Requirements and the System Architecture&Specifications Phase. The datacine will be reasonably artefacts-free, but will not provide restoration functions beyond those that have to take place at the transfer step. The datacine will gather information on the position of faults such as dirt and scratches, in the view of later use for restoration.

Month 36 : D4.3. PPB3 Contactless Playback Tool for audio disks
The Contactless Playback Tool for audio disks will use advanced optics and image processing tools for reading 78rpm disks and vinyls, without any contact with the disk surface, thus increasing the robustness of the playback with respect to dust, scratches, or cracks, on the disk surface.

- Preservation Project Execution and PREFACTIS

Month 30 : D 7.1 PIS1 An Information System for Preservation Management.
The Information System tool (workflow system) will be capable of keeping an accurate track record of the programmes between the time they are first known to the system, up to the point the preservation is accomplished, and the results safely stored after delivery to the archive. This system will be tightly integrated with the Automated preservation tools (WP04, WP05), with the Turnkey System, and with the Export System (WP18 MAD-Turnkey and Export system Integration), and provide ways to store information obtained manually, and specifically when transferring manually difficult media. It will keep track of the events that take place during the transfer, so that these events can be used for quality monitoring. The system will also provide inputs to the Software tool for planning of storage for audiovisual preservation, and to the Software tool for strategic planning for audiovisual preservation.

6.2 Media and mass storage options

D12.1 Archive Storage and Technology Watch Website

D12.2 Storage Calculator

D12.3 Storage quality management

D12.5 10-year Technology Forecast

One result of the User Survey was a widespread view that archivists were unfamiliar with digital storage technology, and had no idea where this technology was going. They were attracted by the dropping costs, but intimidated by the high rate of technology change and implied built-in obsolescence. This report gives the best available industry information and forecasts, to shed light on this difficult area.

6.3 Encoding, files and file types [SAM and MAD]

D12.6 Survey of Digital Formats for Storage

The User Requirements study showed that archivists are also very concerned about the range of digital formats available. Although it is a primary purpose of the website (D12.1) to provide basic information, it is clear that archives need detailed documentation to back up the information already available through the website. This report will be available as a downloadable document (separated into divisions by format for faster access), but it will have management-level information on the website itself, as an update to and extension of the information already provided by D12.1

6.4 Restoration [RES]

Month 22 : D8.1 RST1: Defect and Quality Analysis Framework (Software + Manual)
This SW framework for film and video defects/quality analysis allows fully automatic analysis of the material by analysis modules. Efficiency is enabled by a modular concept where defect analysis for a certain defect can rely on results of other analysis modules. A plug-in mechanism will enable ease of module integration and further extensions.

Month 24 : D8.2 RST2: Restoration Management Tool (Software)
The RMT will provide a single point of information for restoration related decision making and management for the restoration operator. It provides an overview of material to be restored with information on status and progress of restoration. The RMT monitors progress of the restoration tasks.

Month 18 : D8.3 RST3: Restoration Metadata (Report + Software + Manual)
Description schemes to describe typical film/video/audio defects and rich digitisation metadata based on MPEG-7 standard will be developed and documented. A Defect Description API to access and produce such schemes will be provided. The APIs will be documented in an accompanying manual.

Month 24 : D9.2 RA2: High Level Restoration and Defect Analysis Modules (Software + Manual)
This set of modules will be the implementation and documentation of highly advanced techniques to perform digital moving image and sound restoration and analysis.

Month 24 : D10.1 RSS1: Visual Restoration Software Subsystem
This system consists of the SW Restoration Platform and Interactive SW Restoration Tool providing resolution independent, high-quality, semi-automatic restoration functionalities.

Month 24 : D10.2 RSS2: Visual Restoration Hardware Subsystem
The Visual Restoration Hardware Subsystem consists of a hardware system and the disk-to-disk real-time platform providing the functionality to restore digitally, at affordable cost, video programmes with minimum operator time.

Month 24 : D10.3 RSS3: Audio Restoration Software Subsystem
The Audio Restoration Software is a solution that fulfils preservation oriented audio restoration demands: High volume through-put for automatic restoration in fair quality and operator driven manual restoration with highest quality.

6.5 Web-access options [MAD?]

6.6 Metadata and documentation [MAD]

Month 12 : D15.1 : MDS1 Analysis of current audiovisual documentation models (Report)

Month 12 : D15.3 : MDS3 State of the art of content analysis tools for video, audio, speech (Report)
Survey of the existing technologies and analysis of their applicability to audiovisual materials.

Month 32 : D15.2 : MDS2PrestoSpace documentation framework (Report)
Documentation structures, processes, user interface, tools integration framework

Month 32 : D15.4: MDS4 Content analysis tools (Report + Software)
Results of experimentation, operational guidelines, integration of tools in the framework

Month 32 : D15.5 MDS5 Analysis of cross-linguistic IE tools for Metadata Discovery (Report).
Survey of the viable techniques for IE in a cross-linguistic framework. Experimentation on real user data and analysis of the results (Performance Assessment). A Proposal for an effective IE architecture as a metadata discovery tool.

Month 32 : D15.6 MDS6 Semantic interpretation tools (Report + Software)
Results of experimentation, operational guidelines, integration of tools in the framework

Month 24 : D16.3 MPA3 Cross language retrieval and access tools
Survey of the existing technologies and analysis of their applicability to archive retrieval. Definition of a test bed and evaluation of the selected technologies.

Month 24 : D16.4 MDE1 Delivery models (Report + Software)
An lysis of B2B transaction models. Definition of a model for the management of the transactions between the Factory and its customers (open to CRM-systems) including the supported file formats and transcoding functionalities.

Month 32 : D16.1 : MPA1 Content retrieval and browsing for the general public

Specification of retrieval and browsing interfaces for the public access. This will include browsing tools efficiency evaluation (key frame based storyboard, low quality video, types of indexing provided, etc ...) as well as usability of non conventional query methods (e.g., image based search, free text search on transcripts, category tree traversal).

Month 32 : D16.2 MPA2 Conceptual search
Survey of the existing technologies in the field of automatic data models mapping and ontologies and analysis of their applicability to audiovisual archives, with special reference to the results of D15.5. Definition of a test bed and evaluation of the selected technologies..

Month 30 : D18.1 MTI1 Documentation platform for the MAD Factory (Software and Manuals)
This implementation deliverable will provide the software infrastructure for the management of the documentation process of the digitized content, including automatic extraction of metadata and manual annotation and validation. The result of the overall preservation process, that is digitized content and associated metadata, will then be packaged and delivered back to the archive. The same package will also be used as input format for the Publication platform.

Month 33 : D18.2 MTI2 Publication platform for the Results of Digitization and Documentation (Software and Manuals)
This implementation deliverable will provide the software infrastructure for the management of the digitized contents and the documentation metadata, including storage and retrieval facilities. The system will be oriented to offer turnkey services to small archives.

Month 36 : D18.3 MTI3 Turnkey System for Delivering to small Archives (Software and Manuals)
This implementation deliverable will provide the software infrastructure for the management of the whole MAD System made up of the Documentation and the Publication Platform customized to small archives needs.

[the above is specific technology for preservation factories; there is also PrestoSpace work on the market and on business models:
Month 21 : D20.2 Market Analysis
The focus of this market analysis was the sizing and evaluation of the service provider industry which provides services to the archive industry; and assessment of the impact on archive and service provider industries alike of the shift in focus from broadcast customers to consumers.

Month 32 : D20.3 SET3 Business models and plans for PrestoSpace Factories
Intermediate and final scenarios according to different archives models.

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7. PrestoSpace support for Preservation Transfer Projects

7.1 Business Case Planning

Planning for Preservation and Access (Report) – now complete (D13.1)
This report drew on extensive interview of PrestoSpace partners, which tend to be large archives operating mainly in the broadcast sector. To increase our ability to support smaller and non-broadcast archives, this Workpackage will produce a second report concentrating specifically in that sector:

Calculating Preservation and Access Costs and Benefits (Software; freeware) (D13.2)
In support of D13.1, we will produce a simple software tool implementing the needed calculations. For a small number of business models, the software will calculate required investment and ROI, year-by-year.

Preservation needs of small archives (report); ITI; NEW DELIVERABLE D13.3 M36; (full report at M33; management digest at M36). This report will cover the same general topics as D13.1, but focussing entirely on information from, and the needs of, small and non-broadcast archives.

Digital Repositories Explained (report); BBC ; NEW DELIVERABLE D13.4 M30; An explanatory paper covering the emerging concept of **digital repository**. This label has been taken up by various part of the digital library community, and there are standards in development and products becoming available. The purpose of the paper is to explain these developments, and examine their significance for the preservation of media archives.

Service Level Agreements for Storage (report and sample documents); Stream; NEW DELIVERABLE D13.5 M30; It is becoming increasing clear that there is a major alternative to ALL of the decisions about which type of digital storage technology to implement, namely to outsource the storage and let someone else provide the technology. At this point, the key issue is not managing technology, but managing a service relationship. We will draw on the experience inside and outside PrestoSpace, and in the STAG technology group, to produce a guidance report including model or example documents. The key issues are still permanence of the storage (degree of risk of loss) and speed of access, but archivists need to know how to specify their requirements, and what questions to ask, in order to actually achieve the required permanence and access.

7.2 Finding Service Providers

Appendix

7.3 Outsourced Storage

Information on commercial companies that provide storage equipment, consultancy, integration and services is provided in Appendix 10.3.

7.4 Funding, Training and Advice

Past Deliverables
Month 1 : D22.1 DIS1 Project website with clear PrestoSpace description.
This will be the portal for all project information.
Month 2 : D22.2 DIS2 With the User Group: an event to gather User Requirements across the full range of audiovisual collections
Future Deliverables
D22.3 DIS3 Within the first 18 months, there will be day-long workshop events run in conjunction with the major European conferences on audio, film and video.
D22.4 DIS4 Annual Report on Preservation issues for Audiovisual Archives.
This report will be edited annually, and published on the project web site, with a CD-ROM version and a paper version, if possible in conjunction with other IST projects.
D22.5 DIS5 Thereafter, the plan is to get agreement for an annual Preservation Workshop, run in conjunction with all the major audiovisual organisations: IASA, FIAT, FIAT, UNESCO and the EBU.

Past Deliverables
Month 12 : D21.1 : TRA1 Compilation of existing technical literature:
Compilation of essential audiovisual technology, technical manuals of existing playback machines, including scanned documents held on Project Web site.

Future Deliverables
Month 18 : D21.2 TRA2 DVDs of actual equipment operation:
Edited recordings with experts, plus the Web site material.

Month 36 : D21.4 TRA4 Training material for new technology
Course material concerning: digitisation, storage management, restoration methods, metadata organisation.

Month 36 :D21.5 TRA5 Training events:
Courses on digitisation, storage management, restoration methods, metadata organisation. new access and delivery possibilities.

7.5 Using a Preservation Factory

(TO BE UPDATED)

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8. Future Developments & Considerations

The goal of these guidelines is to increase the efficiency of audiovisual preservation. The information provided here is essentially about technology, and the strategy for effective use of technology. But technology is not the whole picture. The other major influences, from copyright to funding, are all to some degree political issues rather than technological. What changes in the political outlook can be expected?

8.1 Political

There is already a major effort for coordination of digitisation at national levels, centred around the NRG[25] and project Minerva[26]. The emphasis of their work has not been on audiovisual material – it has been on paper and to some extent on photographs. However paper and photographs have pioneered the areas of public web access, so audiovisual collections have much to learn from their work. It is possible that the coordination (at the European level) or work being physically done at the national level may lead to some actual European-level development. Certainly portals are already being planned (i2010 and TEL), and actual public repositories could be established at the European level. There is already one privately funded public European repository: the European Archive.

Portals could move in two ways: wider in holdings, and more narrow in scope. It makes little sense to have dozens of disconnected ‘railway history’ portals across Europe (and the world), so consolidation is likely, and will squeeze out those collections that decline to participate in the portal approach. This means that physical institutions (bricks and mortar) have an interesting challenge: their main chance for web attention is via subject-area portals, which emphasise content at the expense institutional identity. A portal with railway images from several dozen collections should attract wider public interest that would be achieved by one regional collection – but the user of the portal may be completely unaware of the ‘bricks and mortar’ insititution that is responsible for pictures getting onto the portal in the first place.

Thus many institutions are advocating being a ‘library without walls’ or similar phrase, but there is a risk of losing institutional identity altogether, as content is aggragated either by portals or by search engines. At least with a portal there is institutional agreement and cooperation. Search engine aggragation technology is quite independent, operating totally outside institutional control. The only choice an online collection has (regarding search engines) is the choice between opening their catalogue and content, or keeping it closed. Opening it could lead to ‘attention without recognition’, as people find material from an insti there

From the public viewpoint, attitudes will also change. As more an more becomes web-accessible, those institutions which do not provide such access will be seen as withholding their content from the public. This pressure is increased by the various 'open' movements (Open Source, Creative Commons, shareware, file sharing …) which all increase the public expectation that public content should, as a matter of course, be available, free, on the internet. The key word is 'public', because much of the material in audiovisual collections (eg commercial music, radio and television programmes) is heavily bound by copyright, and is not at all public. The pressure in Europe arises with respect to *public service broadcasting*. If people feel they've paid for it already (through a public service broadcasting licence), they expect to have access.

It is quite possible that copyright law – or the interpretation of copyright law – will change to allow greatly expanced public access to web-quality content, within 'fair use' copyright provisions.

8.2 Technological

On the technology side, the good new is:

- **the worst will be over**; digitisation of analogue content should be the hardest single step every taken in the history of an audiovisual item. Once digitised, further migrations should be significantly cheaper and faster, and of guaranteed quality.
- **storage costs will continue to decrease;** they have done for more than 20 years, and enough is known about the next 10 years to be confident that the trend will be maintained.
- **access will increase and improve** – In the UK, broadband internet went from 15% to 75% (of homes with an internet connection) in under three years[27].

Technology and politics are not independent, and the increase in broadband internet connections will increase the demand for political change regarding access to audiovisual materal – particularly public service broadcast material.

Finally, institutions may not like to pay maintenance on computer systems, but they have gotten used to it. This fact should make it easier to achieve built-in maintenance of audiovisual archive content – once it sits on computer mass storage technology.

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9. The PrestoSpace Preservation Factory

9.1 Motivation

The motivation for the factory approach to preservation is to minimise loss. In most situations the resources are inadequate to the task. There is a shortage of time, money, training and equipment – and as recent surveys have shown there is also a shortage of understanding of the problem[28]. This situation should force people to attempt the most effective approach for dealing with the overall content of their collections, rather than taking an item-by-item approach. The factory approach is about throughput (most items saved per hour and per Euro) – but the increase in throughput is by taking a systematic approach to the whole problem, and putting resources where they give the best return. The factory approach is not about cutting corners, reducing quality or running preservation sweatshops!

Put in stark terms: if only half the budget (and time) that is needed is actually available, should that be expended randomly on easy and hard items – or concentrated on dealing with the items that work best? It's a hard choice, but the implications are equally stark: dealing with items 'as they come' rather than using systematic selection (triage; separation of hard vs difficult items) takes twice as much time and money. On a fixed budget, the systematic approach – the factory approach – doubles the amount of material saved[29].

If the systematic approach also uses faster technology, automation, bar-coding -- and in general is engineered for efficient throughput, then the effect is another doubling in the amount of material saved – for the same fixed budget[30].

9.2 Approach

The basic approach has been mentioned above (section 5.2). A factory approach is really shorthand for effective engineering and a systematic approach to dealing with a collection as a whole, rather than nibbling away at it in a random or piecemeal fashion.

The basic elements of the approach are:

- knowledge of the whole collection (a collection map)
- automation of the actual workflow
- triage to keep the automation effective

Automation can mean many things, ranging from use of bar-codes to full robotics for tape handling and signal monitoring. The important result documented by Presto, based on preservation work in ten major archives, is that a 50% savings can be made by setting up a specific process (workflow) to deal with preservation work, and then taking inefficiencies out of that workflow – even without using robotics or automated signal monitoring. Sensible engineering of a dedicated process is the key to the first 50% savings – and then advanced technology can give another 50% savings (where there is sufficient scale of material to implement such automation).

9.3 Some history

The '***Preservation Factory***' concept is due to the EC IST-Sponsored project Presto, coordinated by BBC Information & Archives. The first time it was referenced in public was May 2002, during the Presto Multimedia Archive Preservation practical workshop, in London. Before then, it was already present on the Presto Project web site, since at least 12/11/2001[31].

One of the main conclusions of the Presto Project with respect to migration of audiovisual materials to the digital domain, was that the factory approach is roughly 50% cheaper than the on-demand approach. The PrestoSpace Project has then undertaken to develop the technical knowledge, and to prepare the emergence of *Preservation Factories*, as stated on the PrestoSpace web site[32].

Since then, in addition to the technical developments, communication towards the potentials users and service providers has been undertaken, including several events, among others two User Group meetings, in Amsterdam, 18-19/03/2004, and in London, 23-24/09/2004.

It is worth mentioning that several existing and potential Preservation Service Providers assisted both meetings. The message with respect to *Preservation Factories* was probably very convincing, since one of them has since then registered *Preservation Factory* as his own trade-mark…

We wish success to all Preservation Service Providers. However the project is currently recommending no Service Provider with preference to another. Therefore we recommend to potential customers of these services, to consider that any claim by a Service Provider to have the official support or be in line with PrestoSpace project, is overstated.

9.4 Preservation Factory Business Models

Text from Service Providers Task Force, and 18 May 2005 meeting.

Month 32 : D20.3 SET3 Business models and plans for PrestoSpace Factories
Intermediate and final scenarios according to different archives models.

Preservation Factory Services -- Where to Find Them:

Disclaimer: Text to be agreed concerning
Status of a service described as a PrestoSpace Preservation Factory
Method of verification of service provider capabilities and quality
Method of verification of information provided by Prestospace

Information on providers of preservation transfer services, and other preservation services, is given in Appendix 10.2.

9.5 Concluding remarks

The PrestoSpace project is grateful to the EC IST programme for support – and to the PrestoSpace partners for their equal financial support plus all their work. We intent to make this Preservation Guide into a common, sustainable public resource (possibly as a wiki), and invite comments and suggestions on how that can best be achieved.
www.prestospace.org/user_group/forum/index.php

10. Appendices

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10.1 The Audiovisual Culture:

Advisory, training, funding and professional bodies
EC European Commission (the people who run the Eurpean Economic Community)
IST, Cultural Heritage: Information Society and Technology is a major strand of the EC activity, and funds major R&D projects (including Presto and PrestoSpace)

Professional Bodies
FIAT – International Federation of Television Archives http://www.fiatifta.org/
IASA – International Association of Sound and Audiovisual Archives http://www.iasa-web.org/
IAML – International Association of Music Libraries http://www.iaml.info/fr/what_is_iaml

Others:
ARSC – Assoc of Recorded Sound Collections http://www.arsc-audio.org/
CCAAA – Co-ordinating Council of Audiovisual Archives Associations
http://www.iasa-web.org/iasa0015.htm http://www.ccaaa.org/
AMIA – Assoc of Moving Image Archivists http://www.amianet.org/
FIAF -- International Federation of Film Archives http://www.fiafnet.org/

List of more: http://www.iasa-web.org/iasa0019.htm

NGOs
UNESCO – has a archives area, and the UN has special interests in preservation and heritage
ECPA – European Commission for Preservation and Access; Yola de Lucenet; www.knaw.nl/**ecpa**
EBU – European Broadcasting Union; membership of virtually ALL European (in very wide sense; includes middle east and north Africa) broadcasters;

EC Projects:

PrestoSpace:	http://www.prestospace.org/	Erpanet:	http:// www.erpanet.org/
First:	http:// www.film-first.org/first/	Digicult:	http:// www.**digicult**.info/
Minerva:	http:// www.minervaeurope.org/	Presto:	http:// presto.joanneum.ac.at/index.asp
Delos:	http:// www.delos.info/		

UK Projects:

JISC/NSF Spoken Word http://www.spokenword.ac.uk/ http://www.jisc.ac.uk/index.cfm?name=project_spoken_word

Uses BBC sound archive, in an educational digital repository.

JISC digitisation projects:

JISC is funding two digitisation and electronic access project for broadcast media, one with the British Library Sound Archive, one with UK commercial news (ITN)

[More national audiovisual digitisation and preservation projects go here]

ACRONYMS

ARSC	Association of Recorded Sound Collections
BBC I&A	BBC Information & Archives
BFI	British Film Institute
BNF	Biblitheque Nationale Français
Delos	EC Digital Libraries project
Digicult	EC Digital Cultural Heritage project; Seamus Ross
Erpanet	Electronic Resource Preservaton – Seamus Ross
EBU	European Broadcasting Union
EC	European Commission
ECPA	European Commission for Preservation and Access
FIAT	International Federation of Television Archives
FIRST	EC project on digital film
IAML	International Association of Music Libraries
IASA	International Association of Sound and Audiovisual Archives

INA	Institute National de l'Audiovisuel, the French national AV archive
IST	Information Society and Technolgy, a sector of the R&D funding of the EC
JISC	Joint Information Systems Committee – the body which does technical infrastructure for the UK universities
Minerva	EC project to coordinate national digitisation work
NRG	National Representatives Group, the collective body covering all European digitisation work at the national level; coordinates with Minerva
NSF	National Science Foundation – US research funding body; funds digital library projects
Presto	EC project to develop preservation technology
PrestoSpace	EC project to make preservation technology available to all AV collections
RAI	Italian national broadcaster
UNESCO	Heritage / archive part of the UN

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10.2 Service providers

B&G have a list, but we don't have an agreed disclaimer or vetting procedure regarding this information. Also we don't have agreed method of presentation (by geographical area or by service). The list needs to be vetted in some way, and data added where needed to support indexing (and possibly searching) by location and by type of service.

Country	Archive Name	Short Name	Contact	Email address	Services Provided
Austria Austria	ARC Cinedoc Filmproduktion GmbH	ARC Cinedoc	Robert Hecht Peter Schmiedt	rhect@researchstudio.at peter.schmiedt@cinedoc.at	
Belgium	Memnon Audio SA - Audio Archiving Services	Memnon	Michel Merten	Michel.merten@memnon.be	
Denmark	Digital Film		Ove Nyholm	digitalfilm@mail.dk	
Denmark	Digital Film Lab Copenhagen A/S			cph@digitalfilmlab.com	
Denmark	Nordisk Film Lab FilmTeknik A/S Johan Ankerstjerne A/S		Johan Ankerstjerne	lab@nordiskfilm.com	
Denmark	Arvo Fox Film & TV Group			arvofoxtv@mail.dk	
Denmark	Anders Bloch-Jensen			etbrev@erfedt.dk	
Denmark	Videone			mail@videone.dk	
Denmark	Suite Home APS		Birgitte Fleischer	birgitte@suitehome.dk	
Denmark	EuroLab Danmark A/S		Bjarne Cumberland Jacobsen	laser@eurolab.dk	
Denmark	Deel International A/S			deel@centrum.dk	
Denmark	Dansk Video Tekst ApS		Ib Lindberg	mail@danskvideotekst.dk	
Denmark	Columbus Film A/S			columbusfilm@columbusfilm.dk	
Denmark	Xposure - Black and White			mail@xposure.dk	
Denmark	Prolab				
Finland	Digital Film Finland			info@digitalfilmfinland.fi	
Finland	Diginord			info@diginord.fi	
Finland	DER Digital Editing Room			info@der.fi	
Finland	Finn-Lab Oy			finnlab@finnlab.fi	
Finland	Generator Post				
France	Arttech Production Multimedia Co.	Arttech		webmaster@arttech-prod.fr	
France	Centrimage	Centrimage	Alain Lecreux	alecreux@centrimage.com	

France	HiStor	Histor	engineer	mguwang@histor.fr	
France	Media-Matters Europe	Media-Matters	Richard Billeaud	billeaud@rbcconsultant.com	
France	Sony S.A.	Sony	Henri Chite	henri.chite@eu.sony.com	
France	Vectracom	Vectracom	Gérard Letienne	letienneg@vectracom.fr	
Germany	Blue Order AG (formerly Techmath)	Blue Order	Thomas Kleinberger	thomas.kleinberger@blue-order.de	
Germany	Omnimago GmbH	Omnimago	Thomas Thoben	thomas.thoben@omnimago.tv	
Germany	Omnimago GmbH	Omnimago	Olaf Legenbauer	olaf.legenbauer@omnimago.tv	
Germany	Roroco GmbH	Roroco	Patrick Paulisch	pp@roroco.com	
Germany	Studio Hamburg	Stud Hamburg	F. Hoewner	fhoewner@studio-hamburg.de	
Hungary	Magyar Filmlabor (Mr. István Erdelyi, director)		Aradi Laszlo, prod. manager	aradi@filmlabhu	
Hungary	Focus Fox		Ferenczi Gábor	gferenzy@focusfox.com	
Hungary	MTA Sztaki		Kovács György	gkovacs@sztaki.hu	
Hungary	Univ. of Veszprem				
Ireland	Windmilllane		Peter Brady	peter.brady@windmilllane.com	
Ireland	Screen Scene		Jim Duggan	info@screenscene.ie	
Ireland	Moving Media	Moving Media	Simon Factor	simon@movingmedia.tv	
Italy	Advanced Computer Systems	Acsys	S. Grego	s.grego@reply.it	
Italy	Eurix	Eurix	Walter Allasia	allasia@eurix.it	
Italy	Reply	Reply	Andrea Bernicchia	a.bernicchia@reply.it	
Luxemburg	Broadcasting Center Europe	BCE	Christian Garit	christian_garit@bce.lu	
Netherlands	Cineco	Cineco	P. Fonseca	p.fonseca@cineco.nl	
Netherlands	Ciris	Ciris	Ben Willems	ben.willems@ciris.nl	
Netherlands	NOB Cross Media Facilities	NOB	Nick Ceton	nick.ceton@nob.nl	
Portugal	Cinemateca Portuguesa ANIM Dept		José Manuel Costa, vice president	sara.moreira@cinemateca.pt	
Spain	Telefonica Soluciones			rafael.fernandezRuiz@telefonica.es	
Spain	Association of Audiovisual Technical Industries, aiTe		D. Antonio Martos	antonio.martos@aite.es	
Spain	ISKRA		Juan JoséMendy		
Spain	ECAM (escuela de cinematografía y del audiovisual de la comunidad de madrid)		Joan Mariné, Conxa Figueras		
Spain	Image Films Laboratorio Cinematografico		Enric Pareto		
Sweden	Film Teknik AB				
Sweden	Frithiof Film to Video AB		Peter Englesson	peter@frithiof.se	
Switzerland	Videocompany		Agathe Jarczyk	agathe@videocompany.ch	

UK	Ascent Media	Ascent Media	Adrian Bull	adrian.bull@ascentmedia.co.uk	
UK	British Broadcasting Corporation (BBC) Post Production/Resources Ltd		John Crane	John.crane@bbc.co.uk	
UK	BiBC Ltd		Paul Hague	Paul.hague@bibc.com	
UK	BT Broadcast Services	BT	David Hay	david.a.hay@bt.com	
UK	Cambridge Imaging Systems	Cambridge Imaging	Paul McConkey	paul.mcconkey@cambridgeimaging.co.uk	
UK	Clipstream	Clipstream	Paul Swaddle	paul.swaddle@clipstream.co.uk	
UK	Caseys Film & Video		John Casey/Tony Weeks/Simon Ellis	john@caseys.co.uk	
UK	Codeworks	Codeworks	Lee Duddell	lee.duddell@codeworks.net	
UK	Dubbs Ltd		Julie Redmond	Julie@dubbs.co.uk	
UK	Dubbs Ltd/EyeFrame Ltd		James Greenwall	James@eyeframe.co.uk	
UK	IFS Audio (Audio Transfers@Inflight Studios)		Keith Knowles/Leigh Mantle	Keith.knowles@inflightstudios.com	
UK	Infinity Group Ltd.	Infinity Group	Colin Lippitt	colin.lippitt@infinitygroupuk.com	
UK	IPV Ltd.	IPV	David Cole	dcole@ipv.com	
UK	IT Innovation	IT Innovation	Matthew Addis	mja@it-innovation.soton.ac.uk	
UK	ReArc Limited	ReArc	Mr. Colin Lippitt	colin.lippitt@inarc.org	
UK	Snell & Wilcox	Snellwilcox	Paul Walland	paul.walland@snellwilcox.com	
UK	Soho Images		Steve Kyte	steve.kyte@sohoimages.com	
UK	Stanley Productions Ltd		Sheila Bond/Jenny Bond	Shiela@stanleys.co.uk;	
UK	Stream UK Media Services Ltd	Stream	Duncan Burbidge	enquiries@streamuk.com	
UK	System Simulation Ltd	SSL	George Mallen	george@ssl.co.uk	
UK	Take 3	Take 3	Chris Bratt	chris@take3.co.uk	
UK	TC Soho Ltd		Sandra Rumble	Sandra@tcsoho.co.uk	
UK	TK One		David Yeo	David@tkone.co.uk	
UK	TMR (formerly The Machine Room)	Machine Room	Danny Whybrow	danny.whybrow@themachineroom.co.uk	
UK	TVP Archive	TVP	Chris Bannister	chris@tvparchive.co.uk	
USA	Media-Matters	Media-Matters	Jim Lindner	jim@media-matters.net	

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10.3 Storage providers

BBC have an incomplete list, from STAG and other sources. It is largely UK based. As with service providers, it needs a data structure saying what sort of storage service or technology the company provides, plus completion of that standard information across known storage providers – and extension of the knowledge base across Europe.

Company	Contact	Email	Location	Services Provided
Ascent Media	Chris Bannister	Chris Bannister Chris.Bannister@ascentmedia.co.uk		
Ascent Media	Martin Poultney	Martin Poultney mailto:martin.poultney@ascentmedia.co.uk		
Blue Order	Stefan Schneider	stephan.schneider@cms.tecmath.com		
BT	Stephen Murr	stephen.murr@bt.com		
BT	John Davies			
Dalet	David Raeburn	draeburn@dalet.com		
EMC				
Engenio	Dave Love			
Filetek	Ann Dyball	Dyball, Ann Ann.Dyball@filetek.com		
Filetek	Mark Andrews			
Glasshouse	David Price			
Harrier Zeuros				
HP	Andy Morgan	andrew.morgan@hp.com		
IBM	Ian Moore	Ian D Moore iandmoore@uk.ibm.com		
IBM	Rod Allen			
ImationUK	George Purrio			
Intechnology	Loz Kitchen			
Microsoft	Garsham Robertson	garshamr@microsoft.com		
Morse	Andy Newport			
Moving Media				

Network Appliance		
Nexsan	Paul Sleep	
Omneon		
OptoMedia	David Ball	
Pharos	Roger Heath	Roger Heath roger@pharos-comms.com
Pharos	Paul Scott	Paul Scott paul@pharos-comms.com
Plasmon	Steve Tongish	
Plum Data	Joanne Smith	
Quantel		
Redstor	Matt Poulton	
SGI(Silicon Graphics)	Lee Rand	Lee Rand lee@sgi.com
SGI(Silicon Graphics)	John Foster	
SGL	Bernie Walsh	bernie@sgluk.com
SGL	Paul Shonfeld	
Softek	Brian Stokes	bstokes@softek.com

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11. Glossary

[incomplete; requires compilation from all PrestoSpace deliverables]

Carrier
Conservation
Content
Digitisation
Encoding
Ingest
Key frames
Precision
Preservation
Restoration
Thumbnails

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12. References

photo url's for clearance procedure:
UNESCO pictures here: http://webworld.unesco.org/safeguarding/en/_
Besser photos: http://www.archives.gov/preservation/conferences/papers-2003/besser.html
Maintenance photo: http://www.ii.uib.no/~petter/mountains/Dale-03/h11.jpg
Film cold storage: http://www.collectionscanada.ca/preservation/images/amia-gpc-14.jpg
Terra Incognita:
http://www.imagesonline.bl.uk/britishlibrary/controller/subjectidsearch?id=995&startid=1771&width=4&height=2&idx=2
Sinking ship: http://media.ausbg.org/photos/2004/900by600/liner_ss_georgic_sinking_0401_008.jpg
Binoculars: http://morro-bay.com/outdoor/morro-rock/6-7-01-morodory/beebes/curt-w-binoculars.jpg
Big Five: http://www.posterworx.co.nz/images/gen_art/pp30272TheBigFive_G.jpg
Engineer: http://www.concordesst.com/duxford/cockpit/engineer.jpg
Barrister: http://barristersinn.com/db4/00319/barristersinn.com/_uimages/barrister.jpg
Unwashed: http://www.ontariorenaissancefaire.ca/entert.htm
Auto Body: www.explorewisconsin.com/SparkleAutoBody/
Restoration Process: http://www.vcpc.univie.ac.at/activities/projects/FRAME/pics/restoration/frame2.gif
Snow White: www.loc.gov/rr/print/ swann/artwood/aw-object.html
Metropolis: www.filmforum.org/ archivedfilms/metropolis.html

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[1] UNESCO INSTRUMENT FOR THE SAFEGUARDING AND PRESERVATIONOF THE AUDIOVISUAL HERITAGE: CCAAA ISSUES PAPER ; www.ccaaa.org/ccaaa_heritage.pdf
[2] http://cylinders.library.ucsb.edu/
[3] http://www.collectionscanada.ca/preservation/13020206_e.html Ante-chamber of cold storage vault for colour and black-and-white film records where environment is maintained at -18 degrees Celsius (+/- 2°C) and 25% relative humidity (+/- 5%)
[4] http://www.culture.gouv.fr/culture/arcnat/lascaux/en/
[5] http://features.cgsociety.org/story.php?story_id=2919
[6] http://www.bfi.org.uk/incinemas/releases/films/summermadness/restoration.html
[7] http://www.vcpc.univie.ac.at/activities/projects/FRAME/FRAME_Restoration.html
[8] [[Ref here to the handbook of the Danish Film Archive, T Christensen]]
[9] http://www.joanneum.at/en/informatik/bibliothek_detail.php?p_iid=IIS=&p_typ=PRAES&p_id=171
[10] http://www.mtifilm.com/prodct_correct.shtml
[11] Digital Audio Restoration: A Statistical Model Based Approach (Hardcover) Simon J. Godsill, Peter J. W. Rayner
http://www.amazon.com/gp/product/3540762221/103-5019145-5475804?v=glance&n=283155

[12] http://www.cinesite.com/?1241&0&1344
[13] http://www.kodak.com/US/en/motion/newsletters/inCamera/oct2002/snowwhite.shtml
[14] http://www.vcpc.univie.ac.at/activities/projects/FRAME/
[15] http://en.wikipedia.org/wiki/Metropolis_(1927_film)
[16] http://www.kino.com/metropolis/index.html
[17] http://www.geocities.com/Tokyo/Island/3102/f-prez.htm "Film Preservation At The (Digital) Crossroads" David Chute. This article provides a large amount of information on digital film preservation.
[18] http://www.efxmagic.com/ and personal communication with company executives
[19] http://prestospace-sam.ssl.co.uk/tutorials/T6/T6%2d1.html
[20] http://www.iasa-web.org/iasa0075.htm
[21] **Digital Video – 25th Anniversary;** three articles on "Rec 601" in the EBU Technical review of October 2005: www.ebu.ch/en/technical/trev/trev_304-contents.html
[22] **http://www.prestospace.org/project/deliverables/D15-1_Analysis_AV_documentation_models.pdf**

[23] "In late December 2005, weekly singles sales topped CD sales for the first time, as American consumers -- many of them flush with holiday gift cards and loading new MP3 players -- purchased 19.9 million digital tracks but just 16.8 million albums, according to Nielsen SoundScan" http://www.washingtonpost.com/wp-dyn/content/article/2006/02/07/AR2006020702051.html
[24] "The two formats fighting for supremacy as the next-generation videodisc format are HD-DVD (developed by Toshiba and NEC) and Blu-ray (developed by Sony). The DVD Forum supports HD-DVD, but this does not mean that HD-DVD has won the format war." http://www.hddvd.org/hddvd/
also: en.wikipedia.org/wiki/Blu-**ray**_disc
[25] National Representatives Group, the collective body covering all European digitisation work at the national level; coordinates with Minerva
[26] www.minervaeurope.org/
[27] http://www.websiteoptimization.com/bw/0510/
[28] EC project TAPE results, quoted in PrestoSpace Deliverable D22.4(2006)
[29] If problem items take four times as long to process – and if 20% of the material causes problems – then half the budget goes on the problem items. Concentrating the budget on the non-problem items saves that half of the budget, and so allows twice as many items to be processed.
[30] Presto results: efficiency savings of a factory approach. [ref: in D3 – the ACS tables; find exact reference]
[31] http://presto.joanneum.ac.at/may.asp http://web.archive.org/web/20011125124051/presto.joanneum.ac.at/may.asp
[32] http://prestospace.org http://web.archive.org/web/20040413014801/http://www.prestospace.org
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