PUBBLICAZIONI DEGLI ARCHIVI DI STATO
QUADERNI DELLA RASSEGNA DEGLI ARCHIVI DI STATO
81

Imaging Technologies for Archives

The Allied Control Commission Microfilm Project

Seminario, Roma 26-27 aprile 1996

a cura di BRUNA COLAROSSI

MINISTERO PER I BENI CULTURALI E AMBIENTALI
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SOMMARIO

Il semestre di presidenza italiana dell'Unione Europea nel 1996 ha rappresentato l'occasione per importanti iniziative culturali, di confronto e di scambio tra i paesi membri.

Tra queste, un consenso ed una attenzione particolare ha suscitato il seminario internazionale The Image Tecnology for Archives. The Allied Control Commission Microfilm Project, *organizzato dall'Amministrazione archivistica a Roma il 26 e 27 aprile 1996, con il sostegno della Direzione generale X della Commissione europea.*

Nel seminario è stato presentato il progetto di recupero in microfilm e di indicizzazione automatica di un patrimonio documentario di importanza straordinaria per il nostro paese. Si tratta di un progetto di riproduzione e di trattamento informatico dei documenti dei comandi angloamericani in Italia dal 1943 al 1947, conservati presso gli archivi statunitensi: un pezzo di storia fondamentale del nostro paese che l'iniziativa di recupero assunta dall'Ufficio centrale per i beni archivistici contribuirà a mettere in luce attraverso l'Archivio della Commissione alleata di controllo e del Governo militare alleato.

La realizzazione di un programma così ambizioso non sarebbe possibile senza la piena collaborazione dell'amministrazione archivistica d'oltre Oceano e senza l'ausilio di tecnologie e di standard che consentono il recupero, l'indicizzazione e l'accesso ad archivi tanto complessi per il contenuto e per dimensioni. Integrazione internazionale e tecnologie avanzate rappresentano d'altra parte un connubio indissolubile, che consente l'acquisizione di prodotti una volta impensabili, – quale la banca dati di 14 milioni di fotogrammi del progetto Allied Control Commission – ma che pone grandi sfide alla professione: dalla nuova formazione alla obsolescenza tecnologica dei prodotti realizzati.

Per far luce su queste prospettive e queste sfide appunto è stato organizzato dall'Amministrazione archivistica, con il supporto della Comunità Europea e significativamente durante il semestre di presidenza italiana dell'Unione, il Seminario internazionale di cui questo volume presenta gli atti, con l'auspicio che vi sia su questi temi una continuità di intenti e di impegno da parte della comunità archivistica europea ed internazionale.

La realizzazione del seminario è stata curata da Maria Pia Rinaldi Mariani, incaricata dal Ministero per i beni culturali delle iniziative archivistiche per il semestre europeo e da Bruna Colarossi, responsabile scientifico del progetto Allied Control Commission. L'incontro ha inteso esaminare e mettere a confronto, a partire dal caso italiano e attraverso l'esame di esperienze condotte in altri paesi, le diverse tecnologie e metodologie di riproduzione dei documenti che si possono adottare – con i vantaggi ma anche i rischi di obsolescenza connessi – per la conservazione ed il completamento degli archivi e per l'accesso e lo scambio di informazioni anche a distanza.

La dimostrazione on line *del* data base *Allied Control Commission, organizzata durante il seminario, ha evidenziato le potenzialità della migrazione dal microfilm all'immagine digitale e l'opportunità di utilizzare in parallelo tecnologie ibride per garantire sia la conservazione che la ricerca. La fotoriproduzione dei documenti prodotti dai comandi militari alleati rappresenta una tappa significativa nei programmi di recupero e di valorizzazione che l'Ufficio centrale per i beni archivistici ha attivato nell'ultimo decennio, utilizzando appieno i rapporti di collaborazione che si sono sviluppati tra le Amministrazioni di paesi diversi in seno al Consiglio internazionale degli Archivi.*

Una collaborazione che la comunità archivistica intende potenziare e ampliare. Il seminario infatti si è proposto di fornire anche ai rappresentanti delle ammnistrazioni archivistiche dell'Europa centro-orientale, invitati ed affluiti numerosi, un quadro delle possibili soluzioni ai nuovi problemi di accesso ai rispettivi patrimoni documentari.

Il recupero in microfilm e l'indicizzazione automatica dell'archivio Allied Control Commission e la pubblicazione di questo volume testimoniano l'impegno profuso dalla Divisione documentazione archivistica e dalla Divisione studi e pubblicazioni dell'Ufficio centrale verso un'attività di descrizione e di inventariazione che, utilizzando tecnologie innovative e standard internazionali, assicura l'accesso più ampio e diversificato alle fonti archivistiche e permette la diffusione di conoscenze e di esperienze nel campo delle tecnologie e degli standard applicati al lavoro archivistico.

Gli atti del seminario vengono pubblicati dall'Amministrazione archivistica a sottolineare l'importanza del tassello che i documenti recuperati costituiscono nel patrimonio archivistico nazionale.

La Guida generale degli Archivi di Stato *italiani ha consentito un'ampia ricerca preliminare al progetto e permesso di evidenziare quella grave lacuna documentaria negli archivi del secondo dopoguerra, che quasi imponeva l'azione di completamento.*

A corredo degli interventi presentati al seminario, il volume pubblica tre contributi sulla conservazione delle microforme, sull'immagine digitale e sui programmi di fotoriproduzione di archivio, elaborati i primi due nell'ambito dell'attività tecnico scientifica del Consiglio internazionale degli archivi, il terzo realizzato dagli Archivi canadesi quale guida operativa per l'attività in quel settore. Sia gli interventi che i tre contributi sono presentati nella lingua prescelta per l'esposizione o l'elaborazione, con sunti *in inglese per l'italiano ed* sunti *in italiano per l'inglese e lo spagnol*o.

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INTRODUZIONE

Il tema oggi dominante nella professione degli archivisti è quello dell'accesso all'informazione. Nel contesto dello sviluppo tecnologico esso richiede degli approfondimenti a) sia per quanto riguarda le definizioni normative e gli aspetti legali, b) sia per quanto investe i bisogni di integrazione, gestione e comunicazione delle informazioni, c) sia per quanto infine attiene ai problemi della conservazione per un termine temporale economicamente valido.

Il progetto che viene presentato rispecchia queste istanze mettendo in luce:

a) una cospicua collaborazione internazionale che ha permesso e permette di superare le costrizioni di tipo giuridico, riproducendo documenti di rilevante importanza per ambedue i partners senza modificare lo status legale e materiale dei documenti stessi;

b) la possibilità di provvedere alla integrazione dei documenti applicando conoscenze archivistiche e storiografiche non altrimenti ottenibili, nonché alla integrazione della documentazione con altra che le sia supplementare o complementare.

Le modalità di gestione disgiunta e congiunta delle informazioni contenute nei documenti, per mezzo della definizione comune del formato di scambio.

La rispondenza a differenti opzioni circa la comunicazione dei documenti che – per il periodo in cui sono stati creati – rivestono sovente caratteristiche di sensibilità e riservatezza più accentuate nel paese a cui si riferiscono, rispetto al paese in cui si trovano.

c) la metodologia prescelta come coerente con le necessità di salvaguardia fisica dei documenti in rapporto alle possibilità del loro utilizzo in una prospettiva almeno a medio termine, tenuto conto altresì delle risorse finanziarie disponibili per l'attuazione del progetto.

Nel quadro delle riflessioni che il semestre di presidenza dell'Unione Europea ci ha permesso di portare all'attenzione degli altri paesi, l'ammini-

strazione italiana degli archivi ha sostenuto quindi una linea di azione che riguarda il tema dell'accesso, inteso come prima si è detto, concretandola in iniziative per le quali si è avuto il sostegno della Commissione Europea.

Una prima riunione di esperti ha recentemente delineato la strategia per la conservazione e l'uso degli archivi elettronici, stendendo delle raccomandazioni che verranno pubblicate tra breve.

Questo seminario, che si rivolge in particolare ai paesi dell'Europa Centrorientale, intende provocare il dibattito e la verifica di una delle scelte possibili, non soltanto per contribuire alla esperienza della comunità degli archivisti professionali, ma per indirizzarsi altresì a quanti fanno uso dell'informazione in quanto risorsa strategica.

Infine, tra una settimana, un convegno sarà dedicato alla interazione tra gli utenti e gli archivi per verificare le necessità ed esigenze e prospettare nuove situazioni che siano allo stesso tempo innovative e realistiche.

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PLANNING AND IMPLEMENTATION OF MICROFILMING PROJECTS FOR ARCHIVES[1]

La relazione fornisce un quadro generale delle problematiche, della programmazione e delle metodologie per la riproduzione d'archivio, a prescindere che si tratti di microforme che di immagine digitale.

Vengono pertanto esaminate le ragioni più diverse che determinano un piano di riproduzione di documenti, la necessità di una programmazione adeguata (strutture e condizioni per la conservazione, budget, proprietà e responsabilità, applicazione degli standard, ecc.), la scelta e la preparazione dei materiali da riprodurre, il tipo di tecnologia dell'immagine che si intende adottare.

Despite the continuing development of electronic digital imaging processing (DIP) systems, microfilming continues to be a valuable and relatively inexpensive medium for copying archival material. In this seminar we shall be considering both these forms of coping and hopefully by its end you will have some idea of their respective advantages and disadvantages.

Here I shall be concentrating on microforms, but much of what I have to say is relevant, *mutatis mutandis*, to digital imaging or, indeed, any other form of copying.

For the purpose of this paper, I shall use microfilming as a generic term for the process of creating microforms; when a specific format is intended I shall refer to roll film or microfiche respectively.

Reasons for copying

There are a number of reasons why it may be desirable to copy records and archives.

[1]For further reading on this subject see J.A. KEENE - M. ROPER, *Planning, equipping and staffing a document reprographic service: a RAMP study with guidelines,* Unesco, Paris, 1984 - PGI-84/WS/8; B. JUSTRELL-M. ROPER-H.J. WHITE, *Guidelines for the preservation of microforms,* ICA Studies No. 2, ICA, Paris, 1996; M. ROPER, *Policy for format conversion: choosing a format* in *Preservation of library materials. Conference held at the National Library of Austria, Vienna, April 7-10, 1986,* M.A. SMITH (ed.), 1, IFLA Publications No. 40, München, K.G. Saur, 1987, pp. 59-67; D.M . AVEDON, *International standards for microforms, ibid.,* pp. 68-70; *Preservation microfilming: a guide for librarians and archivists,* N.E. GWINN ed., American Library Association, Chicago & London, 1987, *Manual of archival reprography,* L. KÖRMENDY ed., ICA Handbooks, vol. 5, München, K. G. Saur, 1989.

Security copying is used by records managers as a form of insurance against the loss by natural or other disasters of information in their records which would be essential to re-establish the normal operation of an organisation in the aftermath of such a disaster. In such essential or vital records programmes the copies are stored safely at one location and the originals at another. Archivists can guard in the same way against the loss of the information in their most treasured archives.

Substitution copying, in which original documents are first copied and then destroyed, is often seen as the solution to the storage problems created by the mass of current and semi-current records which organisations create in the course of their business. This is totally unacceptable for material which has potential archival value, but even when there is no such value, the indiscriminate copying of records is rarely a cost-effective alternative to a well conceived and directed records management programme in which records are disposed of as soon as they cease to have administrative, legal, financial or archival value and those which have to be retained for longer than the short term are removed from expensive office space to low-cost records centre storage.

Preservation copying is a particular kind of substitution copying in which a copy (or surrogate) is made of an original document which is damaged, decayed or fragile or which will predictably deteriorate as a consequence of excessive use. This may be the archivist's only preservation option when conservation treatment has a low priority or is impractical on account of the cost, lack of appropriate technical facilities or absence of any other suitable form of treatment. It is also a means of protecting documents of high intrinsic value against theft or vandalism. In all such cases the copies should be substituted as the normal form of consultation but the original archives should be retained and kept in secure storage in optimum environmental conditions.

Diffusion copying of current records to which frequent and simultaneous reference is required within an organisation can contribute to efficient administration. At a later stage in the life-cycle diffusion copying of archives can give a considerable advantage both to an archival institution and to its users by making copies of documents widely available for consultation at various points within an archival network or even outside it. The sale of copies can not only reduce demands on the institution's user services but also bring in off-setting revenue.

In this seminar we are concerned primarily with *heritage copying:* that is the acquisition of copies of archives held in accordance with the principle of provenance in one country for consultation in another country for which they constitute a shared cultural heritage. The provision of such copies is one way of resolving disputed archival claims[2].

In the past microforms have been used for all the aforementioned types of copying programme. Now DIP systems appear to hold out the prospect of a means of copying records and archives in an even more compact form and providing instant and simultaneous access. Nevertheless, microfilming continues to have a role to play. Its technology is relatively simple; it is well tried and tested; and it is supported by a substantial body of international standards which make its products virtually hardware independent. Microforms still remain the most cost-effective means of copying where speed and precision of access are not essential. hence, while DIP may be capturing the business copying market, it should be seen by archivists as a complement to and not as a substitute for microfilming, which remains the most practicable means of delivering preservation, diffusion and heritage copying programmes for archives.

Microfilming documents for diffusion or heritage purposes will have its own priorities, which may be independent of those of preservation microfilming, but where they coincide, there are additional benefits of cost-effectiveness.

Planning heritage microfilming programmes

Before embarking on a heritage microfilming programme it is essential that all the consequences of so doing are clearly faced.

First of all the recipient needs to ensure that proper facilities exist for the storage and handling of the microforms. The acquisition of heritage microforms at considerable cost, even if that cost has not been met from your own budget, is pointless if they are to be allowed to become unusable through excessive use or storage in substandard accomodation or, even worse, if facilities cannot be provided for their consultation.

It is necessary also to locate the material involved and to ascertain its approximate quantity in order to estimate the resources required and the timescale and cost of the programme. Where the quantity of material is very large or is shared between a number of archival institutions, the programme may have to be broken down into a series of separate projects, each with its own budget.

Having prepared a budget the next step is to secure the necessary funding. Microforms may be acquired by exchange, donation or purchase. In

[2] *The view of the archival community on the settling of disputed claims: position paper adopted by the Executive Committee of the ICA'*, in *ICABulletin* 44 (June 1995), pp. 12-14.

an exchange agreement each party will need to secure the necessary funding; in the case of donation that will be the responsibility of the holding institution; in the case of purchase it will be the responsibility of the receiving institution. Where more than two countries share a common cultural heritage, a multilateral rather than a bilateral arrangement may be appropriate.

Such funding may come from the institution's own budget, from some other national organisation, from an international or bilateral aid agency or foundation or from a commercial organisation with an interest in the wider marketing of the products of the programme. The terms of the arrangement may often be the subject of a formal international agreement between states (possibly as part of a wider bilateral cultural agreement or settlement of disputed claims) or between national archival administrations[3]; in other instances less formal understandings between individual archival institutions (for example by an exchange of letters) may be acceptable.

When the filming is to be undertaken by a third party (for example, a microfilm bureau acting for one of the parties or a microform publisher preparing a commercial venture), the relationship of that third party to both the holder of the original documents and the recipient of the microforms should be made quite clear. In such cases a formal contract between holder, recipient and the third party is always advisable. This should include a guarantee of the quality of the product and a clear determination of copyright issues.

Whatever the nature and formality of the arrangements, each party should be quite clear about the terms under which the microforms will be provided and about the respective responsibilities of the parties. In particular, the following points should be determined:

- the quantity of documents to be microfilmed;
- the price to be paid (if purchase is to be involved);
- the responsibility for identifying the documents to be filmed;
- the responsibility for providing an inventory of the microforms;
- the kind of microform (roll film or fiche; negative or positive);
- the type of microform (silver-gelatin, diazo or vesicular);
- the filming and processing standards;
- the ownership or custody of the master negative;
- the conditions governing use and reproduction.

I shall return to several of these issues later.

[3] Model bilateral and multilateral agreements for the exchange and supply of microforms will be found in C. KECSKEMETI-E. VAN LAAR, *Model bilateral and multilateral agreements and conventions concerning the transfer of archives*, UNESCO, Paris, 1981 (PGI-81 /WS13).

Identification of material for heritage microfilming

Once the arrangements have been agreed, the specific documents to be filmed should be identified. This should be the responsibility of the recipient institution, but the holding institution should provide guidance on relevant archival fonds and series and, in particular, make available copies of its guides and inventories (published and unpublished). The holding institution should also identify any of the relevant archives which have already been microfilmed to international standards, since the effort and expense of filming anew can be avoided and copies can be provided more cheaply.

Filming entire fonds and series of archives will help to keep down unit costs, although filming individual files or other documentary units will often be necessary. However, extract filming of individual items should be avoided. Where the programme is not confined to entire fonds or series but is to be selective in respect of individual units within series, the recipient institution may need to send a representative to the holding institution to select the material to be filmed, but this will add to the cost of the programme and should be contemplated only where the selection cannot be made from guides and inventories.

Priorities for filming will normally be set by the recipient institution, though account may be taken of any priorities of the holding institution, for example in respect of its preservation microfilming programme or heritaye programmes for other recipients. Establishing quantitative and qualitative priorities will ensure that available funds are used most effectively.

The programme will normally be divided into three stages:

- supplying duplicates of microforms which already exist;
- new copying of fonds and series;
- new copying of individual files or other documentary units.

At each stage there will also be internal priorities related to:

- the uniqueness of the material;
- its historical value; and
- the proportion which is relevant to the recipient.

Preparation for filming

When the material to be copied has been identified and the priorities for filming have been determined, a considerable amount of preparatory work has to be done:

- the documentary units within each series should be prepared for filming in their proper sequence;

– individual documentary units should be checked for completeness;
– loose papers should be arranged in their proper order;
– folded documents should be opened out and flattened and paper clips and staples removed;
– minor repairs essential before filming can take place should be undertaken;
– documentary units should be foliated or paginated (or checked to ensure that any existing foliation or pagination is complete and in sequence) in order to simplify internal identification at a later date and to prove the completeness of the copy; and
– inventories and other finding aids relating to the fonds and series or to individual units should be identified, checked and prepared for copying to serve as finding aids to the microforms.

Filming

Before filming takes place a decision has to be taken as to the kind and type of microform which is to be provided.

The first choice lies between roll film and microfiche, with roll film generally beiny regarded as more suitable for archival applications. Where roll film is selected, a further choice has to be made between differing sizes of film: 35mm film is the preferred option for sequences of documents of varying sizes, on differing shades of paper and with texts in mixed manuscript and typescript and in different coloured inks; 16mm film with its much higher reduction[4] and correspondingly higher packing density is more suitable for material which is of a standard size and homogeneous nature.

The choice of the most suitable kind of microform for a particular task will also determine the sort of camera which will be needed.

To produce microfiche direct requires *a step and repeat camera,* which has a facility for moving the image on the film sideways and up and down within the camera head while the item being filmed remains in a constant position on the camera base. Most models work on a fixed reduction ratio and variations of reduction are not, therefore, easy to achieve.

Filming on roll film is usually undertaken by means of *a planetary (or flatbed) camera*, in which the camera head is suspended on a column above the

[4]The linear reduction achieved by miniturisation is expressed as a ratio of the original, e.g. 20x. The area reduction is the square of the linear reduction, e.g. a linear reduction of 20x gives an area reduction of 400 times.

item being filmed[5]. Changes in reduction are achieved by moving the camera head up and down the column.

Where microforms for use on a microfiche reader are required but variations within the originals dictate differing reduction ratios, roll film (normaily 16mm) may be cut into strips for insertion into pockets within clear plastic jackets. For certain special uses (e.g. maps and plans, engineering drawings) 35mm film may be cut and placed in jackets (up to six frames) or aperture cards (single frames).

16mm roll film may also be produced by means of *flow or rotary cameras,* through which individual sheets of paper are fed automatically into the camera and are filmed as they move along the optical path of the film, which winds on in sequence. This method is much quicker than filming with a planetary camera, but is suitable only for flat loose papers of standard sizes. Because of the risk of damage to the documents, it is not regarded as appropriate for archives.

The careful handling of the items to be filmed is clearly of prime importance in the context of archival preservation and conservation. The process of filming should not be allowed to cause damage to valuable archives.

Documents should be filmed in their proper sequence and in order of their pagination or foliation. Title boards providing archival descriptions of the material to be filmed, start and end boards, the international test target[6] and any other necessary targets,[6] for example to identify, and if possible explain, any gaps in the sequence, should be included in the filming.

Irrespective of the kind of microform is to be produced, the camera should be loaded with silver-gelatin (or silver halide)[7] film on either a cellulose ester (or acetate) or a polyester base. Polyester has greater tensile strength than cellulose ester and is probably more stable. Whatever base is chosen (or available), raw stock should be kept in the recommended environmental conditions and out-of-date stock should not be used.

The one disadvantage of silver-gelatin film is that it can only reproduce shades of grey, from white to black. Colour microfilm is available and has been used for some commercial microform publications, but it is not of archival quality.

[5]For filming over-sized documents cameras with larger bases and longer columns are available.

[6]A target is a chart or document containing test patterns or information identifying and verifying the text as filmed which is itself included in the filming process.

[7]Silver-gelatin is the basic microform medium in which the active ingredient is a lightsensitive silver-gelatin emulsion which is developed chemically; it is normally polarity reversing (i.e. black becomes white and vice versa), although reversal negative film which is polarity retaining, is available and is used for intermediate (second generation) masters.

Processing and testing the microforms

Processing of the silver-gelatin camera film (or master negative) should be undertaken in conformity with international standards[8] and tested to confirm that optimum density[9] and resolution[10] have been achieved (this requires a densitometer and a microscope) and that the chemical processing has been properly completed, leaving no residual thiosulphate (hypo), which will dissolve the image, or silver, which will blacken it[11].

Checking the microforms

Each master negative should be checked frame-by-frame for:
– evenness of focus and density across the frame;
– sharpness and clarity of the image;
– proper titling and targeting;
– the correct sequence of pagination, foliation and items and the absence of unintentional omissions; and
– the absence of mechanical damage caused by faulty camera or processing equipment.

Any completely unsatisfactory master negative should be discarded and the item re-filmed. It may also be necessary to discard a microfiche master if individual frames are defective or individual pages are omitted, but where roll film has been used, only the pages, folios or items concerned need be re-filmed and the new film, after checking, can be spliced into the master in place of the defective frames. However, splicing the master negative is not advisable if a microform copy is intended to be legally admissible in place of the original[12].

In addition to the general tests and checks for evenness of density, it is essential that the master of a roll film should be graded. In this process

[8] International Organization for Standardization, *Photography - processed silver-gelatin type black-and-white film - specifications for stability.* ISO 10602-1995.

[9] Density is the degree of opacity of a film image, normally expressed in logarithmic terms.

[10] Resolution is a measure of the ability to reproduce fine lines and detail on the film from the item filmed; it is expressed as the number of lines to the millimetre as measured from the test target.

[11] The standard tests are specified in International Organization for Standardization, *Photography - determination of residual thiosulphate and other related chemicals in processed photographic materials - methods using iodine amylose, methylene blue and silver sulphide.* ISO 417-1993.

[12] On legal admissibility see G. Weill, *The admissibility of microforms as evidence: a RAMP study*, Unesco, Paris, 1981 (PGI-81WS/25); British Standards Institution, *Guide to preparation of microfilm and other microforms that may be required as evidence* BS 6498: 1991.

variations in density between frames are measured so that appropriate changes in exposure may be effected when duplication takes place. This may be done by eye by an experienced operator using a light box and a standard range of examples of background densities.

Duplicating microforms

At this point it is useful to introduce the concept of generations in respect of copies of microforms. The camera film or master negative constitutes the first generation. From it a second generation copy may be duplicated either as a viewing copy or as an intermediate master. A third generation viewing copy may be further duplicated from that viewing copy or intermediate master[13]. In theory the process could go on for many generations, but at each step from one generation to another there is some loss of quality, and that loss will be greater if the duplication is done from a heavily used viewing copy. Ideally the third generation should be the limit and that is why an intermediate master is essential if large numbers of copies are required.

The master negative should never be used for viewing. It cannot be stressed too much that its sole purpose is to produce a limited number of further copies. The same applies to any intermediate master which may be produced for the same purpose.

Second and third generation copies may be negative or positive and on silver-gelatin, diazo[14] or vesicular[15] stock, depending upon the kind of use which is to be made of them. I shall return to the subject of the choice of appropriate types of microform in a moment.

Duplicate microforms should be subject to the same appropriate chemical tests and physical checks as the master, although the same detailed frame-by-frame inspection should not be necessary where the quality of the master is assured, its density has been properly graded and the duplicator is working correctly.

Caring for microforms

The master negative and any intermediate masters should be handled as

[13] Commercially produced microform publications are normally third generation copies.

[14] In a diazo film the active ingredient is a light-sensitive diazo dye, which after exposure is processed by use of ammonia; it is polarity retaining (i.e. black remains black and white remains white).

[15] The active ingredient in vesicular stock is similar to that in diazo film but it is developed by heat and not by chemical processing; like silver-gelatin film, it is polarity reversing.

infrequently as possible and always with great care and by trained staff. The equipment on which they are used should be kept clean and be well maintained. Viewing copies do not require the same absolute standards of handling, but careful use on clean arid well maintained equipment will help to prolong their working life.

Microforms should always be preserved in conditions which conform to ISO 5466,[16] an essential provision of which is that appropriate and stable environmental conditions should be maintained in the area within which the microforms are to be stored. This may involve the use of airconditioning equipment, though unless large quantities of microforms have to be preserved, a small store room with window or wall mounted stand-alone units may be adequate. If seasonal relative humidity is too high for such units to cope with, they may be supplemented by additional de-humidifiers (of the electrical, not the silica gel type).

As a general rule the lower and more stable the temperature that can be maintained the better, but for practical purposes the aim should be to provide the optimum temperature appropriate to the microform generation. Hence, for the archival storage of master negatives a stable temperature of 13°C ± 2° is recommended; for the storage of intermediate masters a temperature of 25°C ± 2°C is acceptable; and viewing copies may be kept and consulted in reading room conditions, provided that the temperature does not normally exceed 25°C and never peaks above 32°C. These recommendations apply to all types of microforms.

The recommendations on appropriate standards of relative humidity (RH), on the other hand, are more related to the type of film than to the kind of use. In all cases rapid fluctuations of relative humidity should be avoided. A base level within the appropriate recommended range should be selected and relative humidity maintained within ± 5% of that base level. Those recommended ranges are: 15% to 40% for silver-gelatin film on a cellulose ester base; 30% to 40% for silver-gelatin film on a polyester base; 15% to 30% for diazo; and 15% to 50% for vesicular. For medium-term storage higher maximum levels may be permitted, but never above 60% (50% for diazo). Where several film types are to be stored within the same area, the recommended relative humidity is 30%.

The storage environment for all kinds and types of microforms should be free from dirt and dust and from atmospheric pollution. All types of microforms, but especially diazo and vesicular, should be protected from excessive exposure to light (especially ultraviolet light). Within their controlled

[16] International Organization for Standardization, *Photography - processed safety photographic film - storage practices:* ISO 5466-1992.

storage environment microforms should be stored on open shelving which permits the free flow of air. The materials used for shelving, spools and reels and enclosures should be free from acidic, oxidising and reducing agents[17].

A representative sample of the microforms in storage should be inspected at two-yearly intervals in accordance with a sampling plan which ensures that a different batch is inspected each time. If deviations from recommended environmental conditions have occurred, inspection should be at more frequent intervals. Deterioration of either microforms or their enclosures should be noted, the cause of the problem determined and corrective action taken.

Choice of types of microforms

Many of the problems of deteroration of microforms may be avoided by the choice from the outset of the kinds and types most appropriate for the purposes for which they are intended and the conditions in which they will be kept.

In this respect, it should be noted that silver-gelatin microforms will last virtually indefinitely if stored in archival conditions, but are liable to damage if handled frequently and without proper care. Diazo and vesicular microforms are not regarded as being of proven archival quality, but if they are stored in appropriate conditions, they may have a life of between 25 and 100 years, though diazo film is subject to fading when exposed to ultraviolet light. On the other hand, diazo and vesicular film stock is less expensive than silver-gelatin stock, as well as cheaper to process and duplicate. It is more robust and will withstand heavy use.

Bearing in mind these general considerations and the technical constraints and conditions which I have described, it is possible to produce some rules of thumb for archivists to follow in establishing their policies in respect of heritage microfilming programmes.

1. Master negatives (first generation copies) should always be produced on archival quality silver-gelatin stock and should normally be retained by the holding institution. Hence, it follows that the holding institution (or any third party undertaking the filming) needs to have ready access to a supply of silver-gelatin film, cameras in which to use it, the equipment and chemicals to process it and the facilities for checking it. The holding institution also needs

[17] E.g. non-corrodible metals or steel which has been well protected by a corrosion-resistant finish (provided that it does not give off reactive fumes, peroxides or exhudations); paper with an alpha-cellulose content greater than 87%, a pH between 7.5 and 9.5 (7.0 for diazo film) and an alkali reserve of at least 2%; and polyethylene.

to have archival storage facilities for the master negatives which conform to the international standard.

2. Master negatives must never be used for viewing and the holding institution (or any third party undertaking the filming) must, therefore, be in a position to duplicate second and third generation copies from them. Intermediate masters (second generation copies) may be provided to the recipient institution if it has appropriate facilities for their storage in accordance with the international standard and for making third generation copies from them. Such intermediate masters may be on silver-gelatin, diazo or vesicular stock. A balance will have to be struck between the relative cheapness and greater robustness of the two latter types and the archival quality of the former. Polarity may also be a factor: ordinary silver-gelatin and vesicular second generation copies will be positive; reversal silver-gelatin and diazo will be negative.

3. Where the recipient institution has facilities for handling intermediate masters which meet the international standard, it must use them only for making third generation viewing copies.

4. Where the recipient institution does not have suitable facilities for handling an intermediate master, it may be supplied with a viewing copy which has been produced as a second generation copy from the master negative. Vesicular film would appear to be the best option here if positive copies are desirable, but diazo would be equally appropriate if negative copies are acceptable. However, it is generally preferable that viewing copies, especially if more than one or two are required, should be third generation copies from an intermediate master. Again the polarity requirement would determins the type or types of film to be used.

5. Viewing copies, whether second or third generation, do not need the same high standards of accommodation as master negatives or intermediate masters, but if the investment in them is to be safeguarded, some protection from extreme environmental conditions should be provided. If the viewing copies are in heavy demand, it may be desirable for them to be located close by, or even on open access within, the reading room area. Wherever they are stored, controlling relative humidity is more vital than controlling temperature. If relative humidity can be maintairied at 30° ± 5%, either diazo and vesicular viewing copies may be held. If this level is not practicable, then only vesiculat copies should be used, in which case the relative humidity may be set as high as 50% ±5% (though lower would be better).

7. The mix of film types and equipment should be kept to a minimum to hold down the costs, and this may be the final determinant in selecting from the range of options.

Use of microforms

For microforms to be used it is necessary to provide the necessary physical and intellectual facilities for their consultation; that is accommodation and viewing equipment on the one hand and finding aids on the other.

Any archival institution which holds microforms should possess at least two readers or reader-printers, one of which should be restricted to staff use. If roll films are held, a re-wind bench and a splicer will be required for repairing damaged film. This equipment should be maintained in good working order and a stock of essential spare parts, especially light bulbs, should be maintained.

An optional range of extra equipment is also available: for example, reader-printers which produce hard copy prints from film; or motorised drives, perhaps linked to computer assisted retrieval (CAR) devices to provide more rapid access.However, although more sophisticated machines may be cost-effective for staff use, those which are used by the untrained public should be as simple as possible.

The preparation of adequate finding aids should be a major component of the microfilming programme. Without them the microforms will remain largely inaccessible. If the finding aids of the archival institution which holds the original archives meet modern standards of archival description, it may be necessary to do no more than make available copies of these, annotated with the fiche or reel numbers of the rnicroform copies. However, it is unlikely that all the recipient institution's finding-aid needs will be met so easily; at the least translation into another language may be necessary. Hence, it will usually be necessary to compile new guides and lists in the appropriate level of detail and this process will benefit from the use of computers, with their ability to take a single string of input and manipulate it into a wide variety of formats, either online or as print-out. These new finding aids should be compiled in accordance with the international archival descriptive standards now being produced by the International Council on Archives.

Conclusions

To sum up. A well devised and well executed archival heritage microfilming programme will be founded on:

– a good understanding of the location of the archival material to be copied and of its quantity and quality;

– a clear and comprehensive agreement by all the parties concerned on the terms of the programme;

– a realistic budget for the effective use of available funding;
– a work programme which is based upon clear priorities;
– proper preparation of the archives to be copied;
– the availability of equipment and materials which will enable the kinds and types of microforms most suitable for their intended purposes to be produced in confortnity with international standards;
– the provision of facilities for the storage and handling of the microforms which will guarantee their long-term preservating and uses; and
– the availability of appropriate facilities, equipment and finding aids for the effective and continuing use of the microforms.

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Public Record Office, London

IL PROGETTO DI RECUPERO IN MICROFILM E DI INDICIZZAZIONE AUTOMATICA DELL'ARCHIVIO ALLIED CONTROL COMMISSION ITALY 1943-1947

The report describes the Project held by the Italian Archives Administration to microfilm the records of the Allied Control Commission which was operational in Italy since 1943 until 1947.

The records are part of the RG 331 kept by the National Archives and Records Administration. The project is the result of a full cooperation of the two Archives Administrations.

The 16 mm film produced in the US follows the international standards and it is "blipped" for the automatic retrieval and capture of the photograms.

The microfilm is automatically indexed in Italy, with an ad hoc *software and four thousand reels have been indexed until now.*

There will be in the future the possibility of transferring the ACC microfilm to digital media.

La Comunità internazionale degli archivisti ha rafforzato negli ultimi anni i propri legami scientifici e professionali, contribuendo in modo determinante al recupero e alla valorizzazione dei patrimoni archivistici al di là delle barriere nazionali.

È giusto collocare in questo quadro l'iniziativa che l'amministrazione archivistica italiana ha assunto di recuperare in microfilm i documenti della Commissione alleata di Controllo (Allied Control Commission) e del Governo Militare Alleato (Allied Military Government) che hanno operato sul territorio italiano dal 1943 al 1947 e che sono conservati negli Stati Uniti presso i National Archives. Senza la collaborazione diretta che si è istaurata tra l'amministrazione archivistica statunitense e quella italiana, difficilmente un progetto di così vasto respiro ed impegno come quello che ci si accinge a presentare sarebbe potuto arrivare a buon fine.

Programmi analoghi sono stati sviluppati in Germania ed in Giappone per la fotoriproduzione degli archivi dell'Ufficio per il Governo Militare per la Germania (OMGUS) e del Comando Supremo delle Potenze Alleate (SCAP).

Nel progetto italiano tuttavia, gli Archivi nazionali di Washington non sono stati solo il contenitore di ciò che si intendeva recuperare, ma il partner di un'impresa volta alla salvaguardia e alla valorizzazione di un immenso patrimonio documentario ancora largamente sconosciuto. Questo rapporto diretto *professionals to professionals* ha permesso di operare scelte comuni alla tradizione archivistica, di affrontare e superare insieme difficoltà e ostacoli, di condividere un'esperienza tecnico-scientifica che oggi possiamo mettere a disposizione di altri.

Il progetto è stato realizzato con la collaborazione del Centro di fotoriproduzione legatoria e restauro degli archivi di Stato, che ha messo a disposizio-

ne gli spazi, gli esperti e tecnici del microfilm, le attrezzature ed il lavoro di duplicazione delle pellicole.

La società Kodak Italia ha assistito sin dagli inizi il progetto sia per la parte hardware che per il software di indicizzazione automatica dell'archivio. La decisione di operare in un ambiente tecnologico unico, Kodak qui a Roma come negli Archivi nazionali a Washington, è risultata vincente per l'omogeneità e l'affidabilità delle soluzioni e degli standards adottati.

Va infine ricordato l'apporto della Cooperativa Bes, che svolge – con la direzione ed il coordinamento scientifico dell'amministrazione archivistica – l'oneroso compito dell'indicizzazione automatica e della digitazione dei dati.

Il programma di recupero, firmato durante l'XI Congresso del Consiglio Internazionale degli Archivi a Parigi nel 1988, è stato preceduto da un'ampia ricerca preliminare.

L'esame della bibliografia allora reperibile sul tema[1] e degli strumenti di corredo di parte angloamericana confermavano l'estrema importanza dei documenti dell'Allied Control Commission per la storia del nostro paese.

La ricerca è stata indirizzata sia alle ricostruzioni storiche che avevano utilizzato fonti documentarie dell'amministrazione alleata in Italia, conservate a Londra e a Washington, sia alle indagini archivistiche che iniziarono negli anni Settanta, volte a individuare nelle raccolte americane e inglesi le serie documentarie più interessanti, a duplicarne parti da conservare in italia e a costruire nuovi strumenti di consultazione.

In ambedue i casi si coglieva la tendenza a privilegiare fonti già organizzate e "pronte per l'uso", oppure quelle che più si prestavano a un certo mito dell'inedito, della documentazione riservata e segreta e la frequenza di iniziative interrotte, ferme a sintesi provvisorie di materiali parziali[2].

Le finalità e le caratteristiche di queste ricerche avevano orientato anche i programmi di acquisizioni archivistiche in Italia.

La ricerca relativa ai microfilm e alle riproduzioni di parti degli archivi dell'ACC esistenti in Italia, si è concentrata particolarmente sugli Istituti per la storia del movimento di liberazione in Italia. Nel 1976 infatti l'Istituto nazionale di Milano, insieme agli istituti associati, alla Fondazione Feltrinelli e all'Istituto universitario di studi europei di Torino, aveva varato un programma di acquisizione di materiale documentario relativo alla politica degli anglo-americani verso l'Italia nel decennio 1940-50. L'Istituto universitario di studi europei aveva pubblicato una prima guida ai fondi americani sulla Resistenza europea nel 1975 ed un indice, curato da David Ellwood, dei circa

[1] Vedi Bibliografia, p. 34.

[2] G. PERONA, *Ricerche archivistiche e studi sulle relazioni tra gli Alleati e l'Italia*, in «Italia contemporanea», (1981), 142, pp. 89-101.

400 fascicoli dell'archivio del Patriots Branch dell'ACC, n. di codice 10000/125[3].

Avendo in seguito rivolto i propri interessi ad altre aree di ricerca, l'Istituto ha ceduto all'INMLI di Milano la copia dell'indice del PB a livello nazionale e dei documenti raccolti nel corso della ricerca. L'indice del PB del Piemonte è custodito invece presso l'Istituto storico della Resistenza di Torino. Contemporaneamente altri Istituti della Resistenza (Trieste, Napoli e Catania) sviluppavano propri programmi di acquisizioni archivistiche e di ricerca nello stesso campo. Da questa attività è scaturita una guida alle fonti anglo-americane conservate presso gli Istituti[4], che riassume e aggiorna guide e inventari precedentemente pubblicati[5] e che, insieme alla Guida generale degli archivi della Resistenza[6], offre un panorama completo dei documenti disponibili.

Per quel che riguarda gli archivi dell'ACC, non vi si trovano tuttavia nuclei rilevanti di documentazione. Le ricerche sono state infatti promosse sulla base di interessi storici e ricorrenze particolari e volte soprattutto a completare, da parte di alcuni istituti, la documentazione sulla Resistenza nelle rispettive aree geografiche. La scelta è stata inoltre orientata a illuminare l'attività e la composizione delle formazioni partigiane ed i problemi della ricostruzione economica e delle condizioni di lavoro nelle province considerate.

I documenti raccolti sono quindi il risultato di selezioni all'interno delle serie o dei fascicoli e riguardano in particolare gli uffici del Chief Commissioner, del Chief of Staff (Executive Commissioner), della Civil Affairs Section (Local Government, Patriots Branch), della Economic Section (Agricolture, Commerce and Industry, Labor) e del Public Relations Branch.

Anche la ricerca di documentazione dell'ACC presso gli Archivi di Stato non aveva dato esito positivo. In alcuni di essi tuttavia, e soprattutto presso l'Archivio Centrale, erano state individuate alcune serie e collezioni correlate.

Per l'ACS, si ricordano in particolare le serie del Ministero degli Affari Esteri (Segreteria generale, Archivio riservato 1943-47), del CLN (Archivio

[3] *Introductory Guide to American Documentation of the European Resistance Movement in World War II;* D. ELLWOOD, *Nuove fonti americane sull'Italia nella seconda guerra mondiale,* in «Rassegna degli Archivi di Stato», (1976), 1, pp. 111-130.

[4] ISTITUTO NAZIONALE PER LA STORIA DEL MOVIMENTO DI LIBERAZIONE IN ITALIA, COMMISSIONE ARCHIVI-BIBLIOTECA, *Guida alle fonti angloamericane 1940-1950,* Milano 1981 («Notizie e documenti», n. 8).

[5] REGIONE CAMPANIA - ISTITUTO CAMPANO PER LA STORIA DELLA RESISTENZA, *Inventario di documenti anglo-americani sull'occupazione alleata in Italia (1943-45),* a cura di P. DE MARCO, Napoli 1977; M.T. DI PAOLA, *Gli alleati e la Sicilia. Guida ai documenti del Public Record Office (1940-47),* Messina, Istituto siciliano per la storia dell'Italia contemporanea, 1979.

[6] GUIDA AGLI ARCHIVI DELLA RESISTENZA, a cura della COMMISSIONE ARCHIVI BIBLIOTECA DELL'ISTITUTO NAZIONALE PER LA STORIA DEL MOVIMENTO DI LIBERAZIONE IN ITALIA, coordinatore G. GRASSI, Roma, Ufficio centrale per i beni archivistici, 1983 (Strumenti, IC).

generale del Comitato centrale), i documenti microfilmati dalla Joint Allied Intelligence Agency (in particolare la "Collection of Italian Military Records 1935-1943") e dal Dipartimento di Stato degli USA.

Per quel che concerne infine gli altri fondi connessi agli archivi dell'ACC e del Governo militare alleato in Italia e conservati presso gli Archivi nazionali di Washington, sulla base degli strumenti di corredo esaminati era possibile indicare i seguenti Record Groups: General Records of the Department of State (RG 59), Records of the Foreign Service Posts of the Department of State (RG 84, in particolare Caserta Post e Rome Embassy), Records of U.S. Joint Chief of Staff (RG 218), Records of the Foreign Economic Administration (RG 169), Records of the Office of War Information (RG 208).

Sono stati inoltre esaminati tre strumenti di corredo di parte statunitense che sono a disposizione per il Record Group 331[7].

Costituito dai "Records of Allied Operational and Occupational Headquarters World War II" (17.948 cubic feet di documenti compresi tra il 1938 e il 1954), il RG 331 comprende:

– Records of Supreme Headquarters Allied Expeditionary Forces (SCHAEF): 1942-45, 834 lin. ft, 120 bobine di microfilm;

– Records of Subordinate SHAEF Commands: 1943-45, 233 lin. ft, 20 bobine di microfilm;

– Records of Combined Liquidating Agencies: 1945-47, 11 lin. ft;

– Records of Allied Forces Headquarters (AFHQ): 1942-47, 361 lin. ft; 4.544 bobine di microfilm;

– Records of the Allied Control Commission / Allied Military Government (Italy): 1943-47, 4.104 lin.ft, 8.500 cubic feet, 25.500 boxes circa (1 cubic foot = 3 archival boxes).

I documenti dell'ACC rappresentano quindi circa la metà del RG 331. Sia il Preliminary Inventory che la Microfilm Publication n. 1190 comprendono introduzioni sulla storia dell'ACC (poi AC), dell'organizzazione interna e dei suoi archivi[8]. Nella fase di formazione degli archivi, furono utilizzati dalle

[7] La Guide to the National Archives of the United States, National Archives and Record Service, Washington 1974 (il RG 331 è descritto sommariamente nella quarta parte della guida fra i "Records of the executive branch, Department of Defense, Joint and Combined Military Agencies", pp. 191-193); il Preliminary Inventory del RG 331, curato dai National Archives nel 1982, inviato in microfiches all'Ufficio centrale e stampato dal Centro di fotoriproduzione, legatoria e restauro; la descrizione della pubblicazione in microfilm n. M1190 dei National Archives: Subject File Headings for the Records of the Allied Control Commission (Italy) 1943-47. Data l'importanza di questo strumento, sono state acquisite le 5 bobine che riproducono i 18 volumi dei Subject File Headings.

[8] Utile a questo fine anche la Rassegna dell'attività del governo militare alleato e della Commissione alleata in Italia dal 10 luglio 1943 al 2 maggio 1945, a cura della Sezione delle Relazioni pubbliche della Commissione alleata, Roma, Istituto di Arti Grafiche Tuminelli, s.d.

sezioni e sottocomissioni sistemi di archiviazione diversi, ed in particolare fu praticata una versione modificata del sistema decimale del Dipartimento di guerra degli Stati Uniti.

Nel corso del 1946, i documenti delle sezioni, dei quartieri generali regionali e dell'AMG furono concentrati e riorganizzati nell'AC Archives Branch.

L'AC cessò di operare formalmente il 31 gennaio 1947 e le sue funzioni residue passarono alla Civil Affairs Section (G 5) e alle ambasciate inglese e americana a Roma. Gli archivi della Commissione alleata furono affidati all'Allied Forces Records Administration (AFRA) dell'AFHQ per la conservazione e il riordinamento, nel quale prevalsero piuttosto i criteri della pratica archivistica inglese.

Tralasciando qui le vicende relative al programma di microfilmatura integrale degli archivi dell'ACC, interrotto agli inizi e le discussioni e trattative sulla opportunità di una loro permanenza a Roma, ricordiamo che i documenti originali, insieme a tutta le serie dei microfilm dell'AFHQ, furono infine portati a Washington nel 1948, nel Departmental Records Branch Office of the Adjutant General, Us Army. Nel 1955 furono collocati negli Archivi nazionali di Washington, dove sono stati custoditi presso il Washington National Records Center sino al 1995 e attualmente conservati nella nuova sede degli Archivi nazionali in Maryland.

Le autorità britanniche ebbero invece in originale (e nella copia inglese dei microfilm) gli Archivi dell'AFHQ, che costituiscono attualmente il fondo WO 204 del PRO di Londra. Al suo interno, l'unico nucleo consistente di documenti dell'ACC, nella riproduzione fotografica fatta eseguire da C.R.H. Harris per la sua ricerca sull'amministrazione alleata in Italia, comprende copie di documenti tratti dall'archivio del Chief Commissioner e dei quartieri generali regionali.

L'organizzazione dei documenti nell'archivio dell'ACC rispecchia quella interna alla Commissione dopo la riorganizzazione operata nell'ottobre 1944 a seguito delle raccomandazioni emanate da Roosvelt e Churchill a favore di una progressiva restituzione di poteri al governo italiano[9].

I documenti sono suddivisi in tre gruppi fondamentali:

1. quartieri generali
2. regioni e province
3. AMG.

Ogni gruppo è stato identificato con un codice a cinque cifre e articolato a sua volta nelle rispettive suddivisioni interne: sezioni e sottocommissioni per il primo gruppo, le singole regioni e province per il secondo e terzo gruppo.

[9] Vedi Struttura della Commissione Alleata di Controllo, p. 37.

Un numero a tre cifre identifica invece le unità amministrative a qualsiasi livello esse si trovino. Per esempio il n. 142 indica l'unità amministrativa legale sia per il quartiere generale dell'ACC, che per le regioni, le province e l'AMG.

Ne risulta un sistema di 107 "indicator" e 67 "subindicator" che nelle loro combinazioni identificano esattamente il livello organizzativo e il singolo ufficio che ha prodotto le carte[10]. I fascicoli delle unità amministrative sono stati mantenuti nell'ordine originario e numerati progressivamente per serie.

L'AC Archives Branch e successivamente l'AFRA compilarono anche liste dei "subject file headings" relativi a tutti i fascicoli degli archivi dell'ACC.

La *National Archives Microfilm Publication n.1190* consiste di 5 bobine che riproducono i 18 volumi di questi elenchi. Dei fascicoli, organizzati per "indicator" e "subindicator" (il nome dell'unità amministrativa è scritto anche per esteso), sono riportati: il numero, il titolo, l'"original reference number", gli estremi cronologici, la collocazione.

Per quanto riguarda il titolo, solo l'indice completo delle serie e dei fascicoli permetterà di stabilire se si tratta del titolo originario o, per lo meno in molti casi, di una "voce a soggetto" elaborata successivamente dagli archivisti. Così pure per i numeri originali di riferimento, che sono riportati solo per una parte dei fascicoli, e la cui ricostruzione è essenziale per la storia interna dell'archivio e per verificare la completezza delle serie. Non vi è alcuna indicazione invece del numero delle carte contenute nei fascicoli e della consistenza delle serie stesse.

Nel *Preliminary Inventory* del RG 331 è invece indicato lo sviluppo lineare, in metri e piedi, dei documenti delle unità amministrative. Nelle microfiches 204-376 si trova l'inventario sommario dell'archivio dell'ACC, suddiviso in quattro sezioni: i documenti dei quartieri generali, delle regioni, dell'AMG e la miscellanea. Le serie in cui si articolano le sezioni sono precedute da una breve introduzione storica dell'ufficio, con l'indicazione dei nomi di chi ha ricoperto la carica e per quale periodo. È quindi descritta la tipologia dei documenti (general records, cables, pubblications, index and data cards,...), con l'indicazione degli argomenti trattati e degli estremi cronologici. È infine specificato se l'ordinamento interno dei documenti sia alfabetico o per argomento, secondo il "numerical subject classification system".

Lo studio che ha preceduto il progetto di recupero, di cui si è ampiamente riferito, ha confermato l'estrema importanza degli archivi dell'ACC.

L'Archivio si presentava tanto rilevante e fondamentale quanto immenso per proporzioni e complessità interna.

[10] Vedi Codici della classificazione d'archivio, p. 38.

La prima *tranche* del programma si sarebbe conclusa in una data storica: il Cinquantesimo della liberazione e della fine della guerra in Italia. I documenti della Commissione Alleata di Controllo avrebbero colmato una grave lacuna documentaria per quegli anni cruciali della nostra storia e a dato un contributo decisivo alla ricerca e agli studi sulla guerra, sul postfascismo e la ricostruzione.

Si confermava inoltre l'opportunità di una iniziativa generale, con metodologia unificata e tempi di lavoro non misurati, per il graduale ed integrale recupero dell'archivio.

Il fondo si presentava, analogamente alla maggior parte degli archivi militari, ordinato e molto strutturato al suo interno. Questo ha agevolato i numerosi sondaggi effettuati prima di decidere la strategia del progetto.

Ad esempio per il tasso di ripetitività dei documenti, che è risultato irrisorio con la sola eccezione delle traduzioni.

Esclusa la selezione su questa base, restava quella tutta soggettiva dell'importanza e della rilevanza di serie e documenti, da affidare presumibilmente a storici. Progetti analoghi avevano seguito questo corso.

Sembrava tuttavia sconsigliabile e probabilmente impraticabile la scelta di isolare all'interno dell'archivio serie omogenee di documenti riguardanti più direttamente l'Italia o che potessero ritenersi più rilevanti per i nostri interessi archivistici e storici. Gli archivi dell'ACC ben rappresentano infatti l'intricato legame di fattori politici, militari ed economici, interni e internazionali, che ha caratterizzato l'attività delle Commissione in Italia e la molteplicità dei centri decisionali alleati, spesso non coordinati e in disaccordo tra loro e al proprio interno.

Questa difficoltà, ma soprattutto la storia stessa dell'ACC consigliava piuttosto di graduare gli interventi di recupero coniugando il criterio cronologico con l'evoluzione della struttura interna e delle funzioni della Commissione.

L'amministrazione decise dunque la strada, tutta archivistica, del recupero integrale.

Fu una scelta gradita anche agli Archivi nazionali a Washington, perché permetteva la realizzazione di una preservation copy che salvaguardava l'integrità dell'Archivio nel suo insieme. Lo stato di conservazione dei documenti era infatti abbastanza precario, sia per la fragilità dei diversi supporti cartacei, che per lo sbiadimento dell'inchiostro che ne rendeva molti quasi illegibili. La continua manipolazione dei fascicoli e delle carte per la consultazione e la duplicazione aggravava progressivamente la situazione.

Vi era inoltre il problema dei documenti ancora classificati.

Furono ricostruite le fasi e la problematica della *"declassification"* dal Freedom of Information Act del 1967 all'Executive Order 11652 del 1972, fino

al dicembre 1975, quando la Records Declassification Division aveva ultimato la declassificazione della maggior parte dei "security classified records" creati nel corso della seconda guerra mondiale[11]. Restavano tuttavia restrizioni generali e particolari che facevano complessivamente riferimento all'"individual and corporate bodies privacy" e che riguardano anche una parte dei documenti dell'ACC[12]. Lo svincolo di questi ultimi, autorizzato all'inizio del 1974, non comprendeva infatti le carte dell'Office of Strategic Services e quelle prodotte dall'amministrazione italiana, per le quali occorreva l'autorizzazione del governo italiano.

Nella fase preparatoria del progetto infatti, i sondaggi rivelarono l'esistenza di documenti ancora classificati in quasi tutte le serie. Il progetto italiano ha costituito dunque l'occasione per una revisione generale, che ha assicurato anche alla amministrazione archivistica americana una copia declassificata ed integrale dell'Archivio.

L'orientamento a scegliere la riproduzione in microfilm fu allora unanime. Altre tecnologie di micrografia ottica non sembravano ancora attendibili, i costi ed i rischi apparivano troppo elevati. I vantaggi del microfilm per un programma di quelle caratteristiche e dimensioni sembrarono evidenti a tutti, di qua e di là dell'Oceano:

– l'esistenza di standard internazionali e nazionali già consolidati

– la ragionevolezza dei costi, per l'impianto e per la realizzazione, ma anche per la manutenzione e la copia

– la facilità della conservazione, per la stabilità e la durabilità del supporto

– il tipo di consultazione che il microfilm consente, amichevole e diretta per l'utente, anche a distanza e simultanea

– la riproduzione fedele, in grado talvolta persino di migliorare l'originale danneggiato

– il risparmio di spazio

– la facilità del trasporto e della duplicazione

– la possibilità di trattare automaticmente il microfilm per l'indicizzazione e la ricerca delle immagini

[11] Le condizioni americane per lo svincolo e la consultazione dei documenti sono esposte nell'*Introductory Guide to the American Documentation of the European Resistance Movements in World War II*, I, Public Records, compiled by D. W. Ellwood-J. E. Miller, Turin, University Institute of European Studies, 1975, pp. 7-8 e nella Nota di Mark Lynch, in R. Faenza-M. Fini, *Gli americani in Italia*, Milano, Feltrinelli 1976, pp. XII-XV.

[12] General Restrictions in the National Archives, Washington, National Archives 1965, e Secrecy and Disclosure: the Declassification Program of the National Archives, by J. O'Neill, Washington 1970; alle difficoltà tuttora esistenti per la consultazione si riferiscono E. Aga Rossi-B.F. Smith, in *La resa tedesca in Italia*, Milano, Feltrinelli, 1980, pp. 15-17.

– la migrazione possibile e parallela del microfilm verso altre tecnologie più evolute.

Il Programma di fotoriproduzione dell'Archivio è stato realizzato con il microfilm a 16 mm per i documenti e a 35 per i grandi formati, le piante militari, le carte geografiche ed i disegni, per un numero complessivo di 12 milioni di fotogrammi ed un totale di circa 6000 bobine.

L'accordo pluriennale stipulato con la National Archives and Records Administration ha incluso sin dall'inizio l'indicizzazione automatica da parte italiana dell'Archivio della Commissione. Questo obiettivo ha determinato la scelta di produrre un microfilm con blip a due livelli, seguendo anche in questo caso, come per il microfilm, gli standard ISO.

Il blip altro non è che un puntatore automatico, un segno grafico sulla pellicola che il lettore riconosce e che permette la cattura dell'immagine attraverso il software che gestisce il database.

Nel nostro Archivio il blip 1 identifica il fotogramma che riproduce la coperta del fascicolo, che reca il codice di classificazione, il titolo e gli estremi cronologici. Il blip 2 identifica tutti gli altri fotogrammi.

Il software applicativo sviluppato ad hoc per il progetto permette l'indicizzazione a livello di fascicolo e di ogni singolo documento o pagina in esso contenuti. L'indice, sinora realizzato su 4000 bobine, si riferisce ai dati dei fascicoli.

L'indicizzazione a livelli più analitici è rimandata ad una fase successiva, quando saranno attivati programmi di ricerca storica e di utilizzazione distribuita e condivisa del database e dell'archivio delle immagini.

La struttura dei dati nel database è semplice, adatta alle dimensioni ingenti dell'Archivio e aderente alla organizzazione rigida e definita che il comando militare alleato ha assicurato ai documenti.

La descrizione viene eseguita su 10 campi tutti utilizzabili per la ricerca:

Indicator-subindicator
Numero del fascicolo
Numero di bobina
Titolo del fascicolo
Estremi cronologici
Numero dei fotogrammi contenuti nel fascicolo
Nomi
Denominazioni e località
Note

Chiunque abbia diretta esperienza di questo tipo di progetti conosce i problemi e gli ostacoli continui che si presentano, gli inconvenienti tecnici ed organizzativi, gli imprevisti. Questo progetto non ha fatto davvero eccezione, sino alle bufere di neve su Washington che hanno ostacolato il trasferimento

dell'Archivio nella nuova sede in Maryland.

Si è perciò giunti con soddisfazione a questa fase del progetto, con la consapevolezza di essere a buon punto e di poter finalmente vedere realizzate le condizioni per l'accesso e l'uso di fonti documentarie di così straordinario valore storico per il nostro paese.

BRUNA COLAROSSI
Soprintendenza archivistica per il Lazio

APPENDICE

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STRUTTURA DELLA COMMISSIONE ALLEATA DI CONTROLLO

Headquarters

Office of the Chief Commissioner
Office of the Chief of Staff
- Executive Commissioners
- Adjutant
- Archives Branch
- Liaison Office

Political Section

Civil Affairs Section
- Diplaced person and Repatriation
- Education
- Legal
- Local Government
- Monuments, Fine Arts, Archives
- Patriots Branch
- Publich Health
- Public Savety

Economic Section
- Finance
- Property Control
- Index and data cards
- Food, Agricolture
- Commerce, Industry
- Labour
- Transport, Shipping
- Public works, Utilities

Establishment Section
- Executive Officers

Indipendent Subcommissions and Branches
- Air Forces
- Communication
- Land Forces
- Navy
- Captured Enemy Material
- Public Relations Branch

Amg Italy

AC Headquarters
5th Army
8th Army
Udine
13 Corps (Venezia Giulia)

Ac Regional

Sicily Region
- Headquarters
- Provinces

Southern Region
- Zones
- Provinces

Lazio-Umbria (Region IV)
- Headquarters
- Provinces

Umbria-Marche (Region V)
- Headquarters
- Provinces

Sardinia (Region VI)

Toscana (Region VIIII)
- Headquarters
- Provinces

Emilia (Region IX)
- Headquarters
- Provinces

Liguria (Region X)
- Headquarters
- Provinces

Lombardia (Region XI)
- Headquarters
- Provinces

Venezia (Region XII)
- Headquarters
- Provinces

Venezia Giulia (Region XIII)
- Headquarters
- Provinces

Piemonte (Region XVI)

CODICI DELLA CLASSIFICAZIONE D'ARCHIVIO

1. "Indicators"

Indicator	
10000	Headqyarters Allied Commission
10100	Region No. 1 - Sicily
10101	Agrigento Province
10102	Caltanisetta Province
10103	Catania Province
10104	Enna Province
10105	Messina Province
10106	Palermo Province
10107	Ragusa Province
10108	Syracuse Province
10108	Trapani Province
10110	Pantelleria Province
10111	Lampedusa Province
10200	Southern Region
10210	Bari Zone
10211	Bari Province
10212	Brindisi Province
10213	Lecce Province
10214	Matera Province
10215	Potenza Province
10220	Catanzaro Zone
10221	Cosenza Province
10222	Reggio Calabria Province
10230	Foggia Zone
10231	Campobasso Province
10241	Salerno Zone & Province
10250	Taranto Zone
10260	Naples Zone
10261	Avellino Province
10262	Benevento Province
10263	Naples Province
10300	AMG Udine
10400	Region No. 4 - Lazio - Umbria
10401	Frosinone Province
10402	Littoria Province
10403	Rieti Province
10404	Rome Province
10405	Viterbo Province
10500	Region No. 5 - Marche - Abruzzo
10501	Aquila Province
10502	Ascoli Province
10503	Macerata Province
10504	Perugia Province
10505	Pesaro Urbino Province
10506	Terni Province

10507	Chieti Pescara Teramo Province
10508	Ancona Province
10600	Region No. 6 - Sardinia
10700	AMG 5th Army
10800	Region No. 8 - Toscana
10801	Arezzo Province
10802	Florence Province
10803	Grosseto Province
10804	Livorno Province
10805	Pisa Province
10806	Pistoria Province
10807	Siena Province
10900	Region No. 9 - Emilia
10901	Bologna Province
10902	Ferrara Province
10903	Forlì Province
10904	Modena Province
10905	Parma Province
10906	Piacenza Province
10907	Ravenna Province
10908	Reggio Emilia Province
10909	San Marino Province
11000	Region No. 10 - Liguria
11001	Apuania Province
11002	Genova Province
11003	Imperia Province
11004	Lucca Province
11005	Savona Province
11006	Spezia Province
11100	Region No. 11 - Lombardia
11101	Bergamo Province
11102	Brescia Province
11103	Cuneo Province (of Lombardia Region)
11104	Cremona Province
11105	Mantova Province
11106	Milano Province
11107	Pavia Province
11108	Sondrio Province
11109	Varese Province
11200	Region No. 12 - Venezia
11201	Belluno Province
11202	Bolzano Province
11203	Padova Province
11204	Rovigo Province
11205	Trento Province
11206	Treviso Province
11207	Venezia Province
11208	Verona Province
11209	Vicenza Province
11302	Gorizia Province
11303	Pola Province

11304	Trieste Province (Venezia Giulia)
11400	Region No. 14 - Piemonte
11401	Alessandria Province
11402	Aosta Province
11403	Asti Province
11404	Cuneo Province
11405	Novara Province
11406	Turin Province
11407	Vercelli Province
11500	AMG 8th Army

2. "Subindicators"

100	AMG
101	Adjutant
102	American Red Cross
103	Archives
104	Br. Detachment
105	Civil Affairs
106	Communes
107	Districts
108	Epuration
109	Ex. Commissioner
110	Ex. Officer
111	G-1 (US)
112	G-1 (UK)
113	G-4 (US)
114	G-4 (UK)
115	General
116	Hq. Commandant
117	Italian Liaison
118	Liaison Group
119	Liaison Officer
120	Land Forces (MMIA)
121	Mine Clearance
122	Miscellaneous
123	Motor Transport
124	Navy
125	Patriots
126	Personnel
127	Province Officer
128	Provincial Commissioner
129	Public Relations
130	Repatriation
132	Political
133	Operations (G-3)
134	Publications
135	Air Forces
136	Chief Commissioner
137	Administration
141	Local Government

142	Legal
143	Public Safety
144	Education
145	Monuments & Fine Arts (and Archives)
146	Labor
147	Communications
148	Transportation
149	Engineering
150	Public Works & Utilities
151	Finance
152	Price Control
153	Black Market
154	Economic & Supply
155	Civil Supply
156	Supply Group
157	Export
158	Food
159	Agricolture
160	Hemp
161	Industry & Commerce
162	Mining
163	Public Health
164	Displaced Persons
165	Welfare
166	Captured Enemy Material
167	Property Control
168	Purchases & Contracts
201	Military Governor (Venezia Giulia)

THE OMGUS PROJECT: AN AMERICAN - GERMAN AGREEMENT ON THE DESCRIPTION AND MICROFILMING OF THE RECORDS OF THE OFFICE OF THE MILITARY GOVERNMENT FOR GERMANY (US)

Analogamente al Progetto italiano Allied Control Commission, anche nel caso della Germania la collaborazione tra gli Archivi nazionali di Washington e gli Archivi federali tedeschi ha portato al recupero di documenti di straordinaria importanza storica: l'archivio dell'Office of the Military Government for Germany che operò tra il 1945 ed il 1949, che costituisce in molti casi una fonte archivistica unica per le ricerche e gli studi sul secondo dopoguerra.

La relazione ripercorre le tappe cronologiche, le metodologie e le tecnologie adottate per la realizzazione del progetto OMGUS, di cui viene pubblicato l'accordo intercorso con l'amministrazione archivistica statunitense, come un esempio di programma pluriennale di riproduzione documentaria.

For the period from 1945 to 1949, especially for the first years after the unconditional surrender of Germany and the arrest of the "Reichsregierung Dönitz" on May 23, 1945, the records of the four Military Governments of France, Great Britain, the United States of America and of the USSR in Germany are the most important source of information for the history of Germany. This applies for all governmental and administrative levels, local, regional, for the four zones of occupation and Berlin. German agencies were established or re-established and began to work after 1945 with no or very limited political responsibilities.

Correspondingly, the records of German administrative bodies are insufficient for historiography. When looking at the needs of research in contemporary history German archivists after 1949 had two main aims: to achieve the return of the captured German records from France, Great-Britain, the Soviet-Union and the United States and to enable and to facilitate access to the records of the Military Governments of these four Allied occupation powers. The successful cooperation between archivists of the National Archives at Washington and the Bundesarchiv at Koblenz, the return of the bulk of German records kept by the National Archives at Washington to Germany and the fact that already in the years before 1970 records in the custody of the National Archives were opened to German researchers led to the decision that emphasis was to be given to the records of the Office of the Military Government for Germany (US) i.e. the OMGUS records.

The Office of the Military Government for Germany was established in 1945, it was operational until 1949. The records of this body were shipped by a 'Military Records Screening Team' of the US High Commissioner for

Germany (HICOG) to the Kansas City Records Center between autumn 1950 and spring 1953. About ten years later the United States Army transferred these records to the National Archives. About 3,200 shelf meters were integrated into Record Group 260 ('Records of the United States Occupation Headquarters') of the National Archives of the United States and kept in the Washington National Records Center at Suitland/Maryland. This record group comprises all the documents from the American Military Government for Germany except records created from American or allied military units in charge of security or intelligence services but including the records of the US Military Governments of the Länder Bayern, Bremen, Hessen, Württemberg-Baden and the US-sector of Berlin. OMGUS was established on October 1, 1945 taking over the responsibilities and the records of the US Group Control Council (USGCC) which after its establishment in summer 1944 had to plan the future administration of Germany. Records from American representatives in allied bodies like the Allied Control Authority (ACA), the Allied Kommandatura in Berlin, the Combined Travel Board (CTB), the Combined Coal Control Group (CSCG), the Combined Steel Control Group (CSCG), the Joint Export Import Agency (JEIA) and especially the Bipartite Control Office (BICO) were also integrated into Record Group 260. A very valuable complement to the joint American-German project was the inclusion of the records of the Political Adviser (POLAD) to the US Military Governor (Record Group 84)[1].

All these records mentioned are of course of extra-ordinary importance for studying German History after World War II. For the archivists of the National Archives at Washington on the other hand the Record Group 260 is placed among many other records of parallel significance. German historians and archivists had to be aware of the fact that from the American point of view the declassification, appraisal and description of this Record Group had no special priority. The interest of both partners, Americans and Germans, therefore had to be balanced carefully in a joint project, without a mutual benefit for both it would have had no chance for implementation.

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[1] One of the scholarly out comes of the OMGUS project is a publication written by the German participants with a detailed analysis of the history, the responsibilities and the structure of OMGUS, the OMG-Länder governments and other American governmental and administrative bodies: OMGUS - Handbuch, *Die amerikanische Militärregierung in Deutschland 1945-1949*, ed. by CHRISTOPH WEISZ, München 1994, with articles by Josef Henke - Klaus Oldenhage, *Office of Military Government for Germany (US)*, pp. 1-142, Reinhard Heydenreuther, *Office of Military Government for Bavaria*, pp. 143-316, Dieter Emig - Alfred G. Frei, *Office of Military Government for Hesse*, pp. 317-454, Wilfried Schöntag, *Office of Military Government for Württemberg-Baden*, pp. 455-596, Andreas Röpke, *Office of Military Government for Bremen*, pp. 597-670, Jürgen Wetzel, *Office of Military Government for Berlin Sector*, pp. 671-740.

The planning and the preparation of the project started with a pilot study from October until December 1975 with four historians from the Institut für Zeitgeschichte at Munich and one archivist from the Bundesarchiv at Koblenz working in the Federal Record Center at Suitland. The OMGUS records were analysed looking at their value for research. A method of description was developed and tested with a standardized data sheet. The time needed to look through the files, to decide about their importance for historical research and by doing so about their microfilming was determined and the range of the project, i.e. records outside Record Group 260 to be included was defined. The results of this pilot study were discussed in a Forum in March 1976 including historians from the Institut für Zeitgeschichte, several other German research institutes as well as archivists from the State Archives Administrations of Baden-Württemberg, Bavaria, Bremen, Berlin, Hesse and the Bundesarchiv[2].

The aim was evident:

- to identify the records of relevance for Germany history in the bulk of files created by American bodies which operated in Germany between 1945 and 1949,
- to establish a detailed finding aid and
- to enable research by means of microfiches in German archives and research institutes.

An important step within Germany was the approval of the financing of an important part of the total costs of the project by the Volkswagen Stiftung in July 1976 which made it possible to pay two American archivists working for the project. On February 18, 1977 an agreement on the German-American Program for the description and microfilming of the OMGUS - records was signed by the Archivist of the United States, Dr. James B. Rhoads, the Präsident of the Bundesarchivs, Prof. Dr. Hans Booms, and the Director of the Institut für Zeitgeschichte, Prof. Dr. Martin Broszat. The text of this agreement is quoted here as an excellent example for a most successful cooperation between archivists and historians in order to enable, to facilitate and to promote historical research in archives kept by a national archival institution outside the country which is mainly concerned:

[2] Summarizing reports about the OMGUS project have been published by a staff member of the Institut für Zeitgeschichte: H. Weiß, *Abschlußberict iiber das OMGUS-Projekt (1976-1983)*, in «Vierteljahrshefte für Zeitgeschichte» 32 (1984), pp. 318-326, and by J. Henke, from the Bundesarchiv, *Das amerikanisch - deutsche OMGUS - Projekt, Erschließung und Verfilmung der Akten der amerikanischen Militärregierung in Deutschland 1945-1949,* in «Der Archivar», 35, 1982, 2, pp. 149-158.

Agreement

The National Archives and Records Service of the United States, the Bundesarchiv of the Federal Republic of Germany, and Institut für Zeitgeschichte hereby agree to a joint program pertaining to the records of the Office of Military Government for Germany (United States) (OMGUS) in the custody of the National Archives. The program will consist of folder descriptions of the OMGUS records and selected folder filming. The program is estimated to continue for 4 to 5 years. The reproduction of the selected materials will comprise 8 to 9 million frames.

1. Selected OMGUS records will be reproduced on 16 mm silver microfilm. The National Archives will... produce for the Bundesarchiv one silver negative copy which will be mounted in microthin jackets and used as the master copy for further reproductions by the Bundesarchiv. The National Archives will ensure that the negative conforms to the standards of the International Standards Organization for Microfilming with respect to density and resolution...

2. Since the President of the Federal German Archives has obtained the written consent of the responsible British authorities for German reviewers to be given access to those British-origin or combined materials in the OMGUS records which are only being withheld pending British release under their 30-year rule, the National Archives will film and deliver copies of any such folders selected by the German reviewers. The data sheets describing such folders will be annotated with the release date.

Filming of the OMGUS records will be by folder. Short-term British classified records located among the OMGUS records will be filmed with the understanding that the Bundesarchiv will withhold those fiche jackets containing the still restricted records until the British release date has been reached. Records which must remain classified for an extended period will be removed from the folders prior to filming and will be replaced by withdrawal notices identifying the removed documents. The withdrawal notices will be filmed in place with the remaining contents of the folder.

3. The National Archives will determine the sequence in which the boxes of OMGUS records will be provided to the German archivists and historians describing and selecting the records, following wherever possible the preferences of their German colleagues. This should allow for coordination between the declassification and restriction screening and the description and selection process, thereby producing a substantial backlog of camera-ready material so as to minimize bottlenecks and shutdowns of the microphotographic operation.

The National Archives agrees that sufficient material will be available

during the course of the program to allow as many as five German archivists/historians to work continuously.

4. The German parties to the agreement will determine among themselves which folders are to be filmed, but they will examine entire boxes and whenever possible entire series, numbering and describing all folders screened, whether or not they are selected for filming. Folder descriptions in English (except where scholarly accuracy dictates retention of German or other foreign terms) will be provided to all collaborating institutions, on uniform pre-printed data sheets, the form and content of which will be determined by mutual agreement. The data sheets describing each filmed folder will be filmed as the first frame of the reproduction of that folder. The original data sheets will be retained by the National Archives. A total of two electrostatic copies of the data sheets will be produced by the National Archives for the Bundesarchiv and the Institut für Zeitgeschichte, respectively. Copies of subsequently produced indexes made separately or jointly, manually or computer-assisted, will be exchanged among all parties to the joint program.

5. For a period limited to three years, the National Archives will employ one staff archivist and one staff archives technician for the joint project. The Institut für Zeitgeschichte will pay the National Archives Trust Fund the amount of $ 103,000 to pay the salaries of these persons for the three years. The duties of the two staff members will include processing the records to be examined by the German reviewers in addition to other professional activities such as assisting in the identification of the provenance of the records and aiding in the description. The National Archives will assure that the preparation of the records for review is completed within the three year period. If at the end of the three year period it appears that further assistance of the National Archives employees is desirable the parties will reopen discussions. The three year period will begin three months after the signing of this agreement. Payment for the staff positions for the first year will be $ 29,000; second year will be $ 35,000; and, the third will be $ 39,000. The payments for personnel costs (staff positions) will be paid semiannually, beginning 4 weeks after signing of the contract.

6. The German parties will pay at the beginning of the work for the first portion of the filming (1.33 million reproduced at 3c each)... Costs for the filming are based on a projected three year time period. Filming costs will be reviewed at the end of the three years and adjusted if necessary.

7. Payments for film costs will be made on the basis of the respective annual budgets in the Federal Republic of Germany... The initial payment will be adjusted based on the anticipated first year costs. Unexpended funds will be credited to the succeeding year's payment".

On the basis of this agreement German archivists and historians worked

from May 1977 until June 1980 in the Washington National Record Center at Suitland/Maryland. More than thirty German participants in the project stayed at Washington, some of them only for several month, some for up to more than one year. They came from the Bundesarchiv, from the German State Archives Administrations involved (Baden-Wüttemberg, Bavaria, Berlin, Bremen, Hesse), the Institut für Zeitgeschichte and other German research institutes. Continuity was ensured by American colleagues who participated in the project from its beginning to its end, namely Brewster S. Chamberlin and John Mendelsohn.

After the declassification of the OMG – files by American colleagues the German archivists and historians looked through the files. If a file was of interest for scholarly research it was chosen for microfilming and a detailed description was made using the data sheet mentioned before. From the very beginning of the discussions the participants in the project agreed to use English as the language of description. If a file was not chosen for microfilming its reference code was noted on a list with the remark: 'not of historical value' and the description was limited to a very short, rather summarizing title. The decision not to film and to describe a file with the detailed data sheet procedure was not an appraisal decision which led to the destruction of a file. It only meant that within the project the file was not regarded as being of special interest for German researchers and therefore it was not to be included in the microfilm program.

In the framework of the project about 160,000 folders which are kept in 8,000 socalled record center boxes with an average of 20 folders each had to be checked by the German archivists/historians. Very close to the figure which were found during the pilot project one third (about 50,000 to 55,000) of the folders were chosen for microfilming and the detailed description produced on the data sheet mentioned above. The archivists from the Bundesarchiv of course concentrated on the records of OMGUS, i.e. the records produced by the central offices of the US occupational agencies, whereas the colleagues from the German Länder archives dealt with their respective OMG offices. The microfilming was done on 16-mm silver microfilm which was cut and mounted into microfilm jackets. The procedure described in article one of the agreement proved to be technically difficult: it is not possible to get a good quality diazzo copy from a jacket with the first, third of fifth silverfilm copy. One might take it as another proof of the excellent cooperation with the colleagues from the National Archives that after brief consultations in 1977 the agreement was modified: the Bundesarchiv received the original silver negative film mounted into jackets whereas the National Archives agreed to keep a copy of that film.

Altogether about six million frames were taken, the jackets were sent to

the Bundesarchiv where the duplication on diazzo fiches was done for the German partners involved in the project. Microfiches for the records of OMGUS and other agencies, i.e. offices with central responsibilities for the American zone of occupation, are kept and are open for research in the Bundesarchiv at Koblenz. Correspondingly the State Archives of the German Länder keep the microfiches of the respective OMG Länder offices: OMG Bavaria in the Hauptstaatsarchiv München, OMG Württemberg-Baden in the Hauptstaatsarchiv Stuttgart, OMG Hesse in the Hauptstaatsarchiv Wiesbaden, the Staatsarchiv Marburg and Darmstadt, OMG Bremen Enclave in the Staatsarchiv Bremen and OMG Berlin Sector in the Landesarchiv Berlin. Most of the OMGUS central files as well as many of the OMG Länder files are also available in the Institut für Zeitgeschichte at Munich. In a second project the Institut has established a computerized indexing system with key words in order to facilitate access to the datasheets and thereby to the microfiches.

The project based on the agreement between the National Archives, the Bundesarchiv and the Institut für Zeitgeschichte from February 1977 has proved to be successful. It was not a matter of course that after a period shorter than thirty years the National Archives of the United States agreed to the microfilming of and the access to the totality of the records of the Military Government for Germany. The benefit of the project is mutual. The description and the microfilming of the records of course turned out to be very helpful to American researchers and archivists, too. In Germany the availability of the microfiches and their detailed description is not only extremely helpful for scholarly research but also for answering questions from German government and administration. The decision to microfilm the OMGUS and the OMG Länder files to a large extent is only justified because of the costs and the time saved by German researches who otherwise would have been obliged to travel to the United States. A different approach has therefore been taken for the records of the British Military Government in Germany. A joint project was planned and executed by the Deutsches Historisches Institut at London, the Bundesarchiv, the archives administrations or the research departments of the Länder Berlin, Hamburg, Lower Saxony, North Rhine-Westphalia and Schlewig Holstein in cooperation with the Public Record Office and with financial support of the Volkswagen Stiftung[3]. The result of this project is an extensive inventory with descriptions in English of the records of the Control Commission for Germany, British Element, including records of different

[3] Reports on several aspects of this project have been published (with summaries for the articles in English); *Britische Besatzung in Deutschland, Aktenerschließung und Forschungsgelder*, edited by A.M. BIRKE and E.A. MAYRING, London, Deutsches Historisches Institut, 1992.

provenance but related to the British government and administration of Germany from 1945 to 1949[4]. Microfilming the records has not been planned in the framework of this project. The original records can be consulted in the Public Record Office of Great Britain. A different solution has been taken for the French zone of occupation. In Colmar, i.e. close to the border to Southern Germany, a special archives was installed by the Foreign Office of France: Archives de l'occupation française en Allemagne et en Autriches entre 1945 et 1955. Additionally and as was decided by France, Great Britain and the United States between 1952 and 1954, the records of the Allied High Commission (1949-1955) are kept in the custody of France in the Archives at Colmar. A leaflet is available on request with some data about the archives kept at Colmar and the access regulations[5].

The records kept in the custody of the National Archives at Washington which are related to the American occupation of Germany have been described and microfilmed in a joint project. The records of the Public Record Office have been described and an extensive inventory has been published. The corresponding Franch records as well as the record of the Allied High Commission for Germany have been concentrated in one archival institution and are open for scholarly research. It is to be hoped that this will apply to the records of SMAD, the Soviet Military Administration of Germany, correspondingly in the near future.

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[4] *Akten der britischen Militärregierung in Deutschland, Sachinventar 1945-1955, Control Commission for Germany, British Element, Inventory 1945-1955*, edited by A.M. BIRKE, H. BOOMS, O. MERKER, in co-operation with the Deutsche Historisches Institut, London and the Niedersächsisches Hauptstaatsarchiv Hannover, voll. 11, 1993.

[5] Ministère des Affaires Etrangères, Bureau des Archives de l'occupation française en Allemagne et en Autriche, Cité Administrative - Bâtiment J., 3 rue Fleischhauer, F - 68026 COLMAR Cedex.

LA INFORMATIZACIÓN DEL ARCHIVO GENERAL DE INDIAS: ACTUALIDAD Y PERSPECTIVAS

Nell'occasione del V centenario della scoperta dell'America è stato varato in Spagna un grande progetto per l'informatizzazione dell'Archivio generale delle Indie, con l'obiettivo di migliorare e di unificare il sistema descrittivo, di ampliare il servizio di consultazione e di ricerca sui supporti digitali anziché sugli originali, di controllare la gestione e la movimentazione dei documenti e dei fondi.

Il progetto ha consentito di acquisire all'amministrazione archivistica spagnola un'esperienza unica, consolidata nell'arco di cinque anni: un sistema automatico integrato, in grado di svolgere tutte le funzioni connesse ad un archivio e di accogliere ed elaborare in un unico sistema informativo tutte le conoscenze ed i dati relativi alle fonti.

En el año 1991 se ponía a disposición de todos los usuarios del Archivo General de Indias un nuevo sistema informático. Se había realizado en una importantísima operación de mecenazgo cultural, en el marco de las actividades conmemorativas del V Centenario del Descubrimiento de América, con la participación conjunta del Ministerio de Cultura, IBM España y la Fundación Ramón Areces.

El nuevo sistema trataba de dar una respuesta global a las necesidades de automatización de un archivo histórico, mediante el desarrollo de un sistema integrado capaz de atender a la mayor parte de sus funciones:

– A través del módulo de Gestión de Usuarios se atienden las funciones de control de la investigación y la sala de lectura, el control del movimiento de fondos, el seguimiento de las peticiones de reprografía, la obtención de estadísticas de uso del archivo, etc.

– Por medio del Sistema de Información y Referencia, se dispone de un sistema unificado de información descriptiva como medio para acceder a los documentos originales, manteniendo el control intelectual de los mismos, y facilitando por una parte la recuperación por la vía tradicional que sigue la estructura orgánico-funcional del Archivo, y por otra el acceso directo a través de palabras clave o descriptores.

– y por último, para conseguir sustituir la consulta de los documentos originales del Archivo por medio de imágenes digitales en pantalla o papel, se puso en marcha el Sistema de Almacenamiento Optico Digital de Imágenes, la parte más novedosa (entonces y todavía hoy) y espectacular del proyecto, por las grandes posibilidades que en ella se incluían.

En el momento de la implantación del sistema éste se basaba en una Red de Area Local Token Ring, con un miniordenador IBM AS-400 como servidor de bases de datos y con PS/2 con OS/2 como servidores de imágenes, impresión, comunicaciones, etc. Unas 40 estaciones de trabajo (la

mitad de ellas en la Sala de Lectura) daban el correspondiente servicio a los usuarios.

1. Estado actual

Desde aquel momento el Sistema Informático ha estado y está en uso en el Archivo, dando un importantísimo servicio a la investigación. Han pasado ya diez años desde que se inició esta apasionante e innovadora operación (y cinco desde que se implantó el sistema), por lo que ya podemos verla con una cierta perspectiva temporal. ¿Cuál es la situación actual del Sistema Informático del Archivo o mejor, del Archivo General de Indias automatizado? ¿Qué cambios ha producido el uso del sistema en el funcionamiento normal del Archivo?. Los cambios pueden analizarse en múltiples aspectos; aunque hay alguno especialmente significativo.

Hoy el sistema sigue funcionando con unas cincuenta estaciones de trabajo a disposición del personal del Archivo y de los investigadores, y se han puesto en marcha algunas importantes operaciones para actualización del sistema, de los soportes y de la propia información.

El módulo de Gestión de Usuarios, que se ya se puso en funcionamiento en una primera versión en el año 1988, continúa prestando sus servicios prácticamente con las mismas características y con sólo ligeras modificaciones para actalización y mejora.

El Sistema de Información y Referencia, el corazón del sistema, ofrece magníficas herramientas para el usuario, tanto el personal del Archivo como el investigador. En el año 1992 terminó la operación de conversión retrospectiva de todos los tradicionales instrumentos de descripción del Archivo al nuevo sistema: todos los catálogos, inventarios o índices hasta entonces existentes, quedaban incorporados al mismo, y pueden ser por tanto accesibles de manera inmediata.

Por otra parte toda la información descriptiva que se va preparando a diario en el Archivo se incorpora directamente al Sistema Informático, al haber prácticamente desaparecido el uso del papel como soporte del trabajo descriptivo. Si en una primera fase se pasaba la descripción del papel al soporte informático, desde hace tiempo todo el trabajo descriptivo se realiza directamente en ordenador. En compensación el sistema permite posteriormente, partiendo de la información contenida en las bases de datos, obtener los tradicionales instrumentos de descripción en papel.

El acceso a la información es evidentemente mucho más rápido con el nuevo sistema, ya que "toda" la información descriptiva puede ser consultada directamente en pantalla, permitiendo acceso a la información a través de la

estructura jerárquica o directamente a través de palabras clave. Comparativamente con el sistema tradicional (los instrumentos de descripción siguen estando en la Sala de lectura en su formato en papel), las diferencias son muy significativas: con el Sistema informático hay más información y su recuperación es mucho más fácil.

En cuanto al tercer módulo del Sistema, el Sistema de Almacenamiento Digital de Imágenes, está ofreciendo enormes ventajas: con los once millones de páginas digitalizadas, aproximadamente el 13% del total de las existentes en el Archivo, se está dando un servicio de consulta del 30%, lo que significa que en la práctica se evita la manipulación de los papeles por parte del personal y de los investigadores casi en una tercera parte del total. De cara a la conservación, el beneficio es evidente. Pero también es evidente el beneficio obtenido por el más rápido servicio: los diez o quince minutos que lleva el transportar los documentos desde el depósito a la Sala de Lectura, se convierten en uno o dos minutos, para disponer del documento directamente en la pantalla.

Vamos a analizar con más detalle algunos de estos puntos.

2. Ventajas de utilizacion de sistemas digitales

2.1. Ventajas par la conservación

Para tener una idea del beneficio que estas nuevas tecnologías aportan al trabajo archivístico, es muy interesante comparar el uso del sistema de consulta a través de imagen digital en relación con la consulta de la documentación original.

En el Archivo General de Indias, hoy día podemos afirmar que la tercera parte del servicio de consulta de documentos se realiza en pantalla, lo que quiere decir que en cierta medida se evita la tercera parte del deterioro producido normalmente por la manipulación de los documentos originales.

Si consideramos el número de asistencias de investigadores para consulta a través del sistema informático y el número de asistencias de investigadores que acuden para consulta de documentación original, durante los últimos años en torno al 30% de las asistencias de investigadores al A.G.I. ha estado dirigida a la consulta de documentos en pantalla, a través del sistema digital.

Parece, pues, claro que el beneficio para la conservación de los documentos es importante, con sólo considerar el porcentaje de "deterioro por la manipulación de la consulta" que se evita. Téngase en cuenta que el Archivo General de Indias tiene una media diaria que desde hace mucho tiempo se

mantiene en torno a 55 asistencias de investigadores, y algunos documentos podían ser solicitados para consulta en la Sala más de cincuenta veces a lo largo de un solo año.

2.2. Reproducción de documentos

No sólo en la consulta directa de los documentos a través de pantalla, también en la obtención de reproducciones ese obtienen grandes beneficios: El 33% de las copias en papel se vienen realizando en los últimos tiempos a través del sistema informático, sin recurrir al original.

Los documentos que se están visualizando en pantalla pueden ser reproducidos en papel a petición del investigador. A través de un fácil menú el usuario puede pedir la reproducción de documentos completos o de parte ellos según va realizando su trabajo. Una vez completada su petición y abonados los derechos correspondientes, el sistema imprimirá la copia en papel solicitada. Las copias pueden entregarse el mismo día o al día siguiente.

2.3. Ventajas para la investigación

El análisis de la consulta que venimos haciendo es en cualquier caso puramente numérico, y tiene que ver más que con la investigación propiamente dicha con la manipulación de los documentos. Es difícil realizar estadísticas sobre los resultados prácticos para la investigación.

Pero es seguro que si pudiéramos comparar objetivamente los resultados del trabajo de investigación obtenidos con el sistema informático en relación con los que se podían obtener a través del sistema puramente manual nos encontraríamos con datos muy relevantes. Pero como esto no lo podemos realizar, nos tenemos que contentar en este caso con ver el "grado de satisfacción" experimentado por los investigadores.

Y son muchos los investigadores que me han comentado las ventajas del nuevo sistema a pesar de los posibles inconvenientes, y que me han hablado del ahorro de tiempo que han conseguido en su trabajo. A pesar de que es evidente que no todos encuentran información y documentación digitalizada para sus temas específicos, a pesar de que se trata de nuevos sistemas que requieren su perfeccionamiento y mejora, y a pesar de que se priva al usuario del "placer" de tocar los viejos papeles o pergaminos.

A veces algunos colegas me preguntan: ¿cómo es posible que el investigador acepte sin problemas la consulta de documentación a través de reproducción digital cuando estaba acostumbrado a "tocar" los papeles originales? Además se han de acostumbrar al uso de unas tecnologías que no siempre son fáciles de usar.

2.4. Localización más rápida de los documentos

Mi respuesta en este caso incluye varias razones. La primera es que la localización de los documentos en el sistema informático es mucho más rápida que con el sistema tradicional de instrumentos de descripción. Téngase en cuenta que es posible acceder a la información por varios caminos, dos de ellos fundamentales: el primero es el camino tradicional o "vía del principio de procedencia", esto es, a través de la división orgánico-funcional de los papeles del Archivo. Es el camino que sustituye a la fórmula habitual que va de lo general a lo particular, de la guía al Inventario, al Catálogo y al Indice. Permite el acceso unificado a la información, y evita el uso de multitud de inventarios, catálogos, índices o ficheros.

La otra forma fundamental de localización de documentos es a través de palabras clave o descriptores. Es la vía más usada por los investigadores, y en realidad reúne en un único índice topónimos, nombres de persona, cargos, instituciones, materias... Lo que antes estaba disperso en multitud de índices auxiliares, ahora está en un único índice con varios cientos de miles de entradas. La rapidez en la localización de la información es pues absolutamente evidente. De hecho muchos investigadores utilizan de forma prácticamente única este camino de consulta, aunque todos sabemos que lo mejor es combinar las dos fórmulas de búsqueda.

2.5. Más información descriptiva disponible

Pero además de la localización más rápida de la información, el sistema ha permitido poner a disposición de los usuarios "más cantidad de información", ya que antes no era fácil acceder a "todos" los diferentes instrumentos de información, muchos de ellos en fichas sueltas y que sólo estaban a disposición directa del personal del Archivo.

Aparte está el hecho de que la incorporación de la nueva descripción al sistema informático es inmediata.

2.6. Más documentos en el Archivo

No solamente más información descriptiva sobre los documentos del Archivo. El proyecto de informatización ha permitido "completar" el Archivo con nuevos documentos, ayudando a la consecución de uno de sus objetivos fundacionales: "hacer un Archivo General" para reunir en la Casa-Lonja de Sevilla todos los "papeles de Indias". Unos cuatro millones de páginas de documentos del Archivo General de Simancas y del Archivo Histórico Nacional, relacionados con los territorios ultramarinos, pueden ser consultados

en Sevilla, ya que han sido digitalizados y una copia de los discos ópticos correspondientes está disponible en el Archivo General de Indias.

Hoy día, 525 legajos de la Secretaría de Guerra del Archivo General de Simancas, 25 legajos de la colección de Documentos de Indias de la Sección de Diversos del Archivo Histórico Nacional, 331 cajas con expedientes de Pruebas para ingreso en Ordenes Militares de Caballeros de Origen Americano, 895 legajos de la Sección de Ultramar, 230 legajos con papeles del Consejo de Indias, 42 legajes de la Sección de Inquisición, todos ellos del A.H.N., están en la actualidad disponibles y son probablemente más fáciles de consultar en el Archivo General de Indias, que en el Archivo donde se encuentran sus originales.

3. El trabajo interno del Archivo

Es fácil hacerse a la idea de que un sistema tan complejo y a la vez completo como el que está funcionando en el Archivo General de Indias, ha influido también en gran medida en el trabajo interno del Archivo. El Servicio de Referencia, el proceso de atención a las peticiones de reprografía, todo lo relacionado con la descripción y consulta de documentos..., ha sido modificado de resultas de la implantación del Sistema Informático.

3.1. El Servicio de Referencia

El Servicio de Referencia del Archivo, ha visto modificadas buena parte de sus rutinas de trabajo: desde la forma de guardar la información de los investigadores (los "expedientes" de investigadores físicamente sólo están formados por la solicitud de tarjeta, la carta de presentación y la posible correspondencia, el resto de los datos sobre la consulta queda dentro del sistema informático), a la forma de realizar la propia tarjeta de investigador y sobre todo la forma de "informar" al investigador. Desde el primer momento, todo el proceso se halla automatizado. Es posible obtener más de una veintena de informes con modelo ya "normalizado", seleccionando únicamente a través de un simple menú: resúmenes de servicios, listas de investigadores o de temas de investigación, expediente de investigador, etc. Este conjunto de informes y datos estadísticos ayudan a conocer más profundamente las necesidadesde los usuarios y por tanto tener más información para conseguir el mejor servicio.

3.2. La Sala de Lectura

El control de la Sala de Lectura, las peticiones y reservas de documentos,

y el movimiento de fondos dentro del Archivo (dónde están los documentos, quién los tiene o quién los ha consultado a lo largo del tiempo), es otro de los aspectos que se ve beneficiado claramente por el cambio informático, al igual que el control de las peticiones de reproducción de documentos. Las ventajas del sistema para la atención al público que solicita información por correspondencia son también obvias.

3.3. El trabajo archivístico

Y en lo que respecta al trabajo archivístico, principalmente los aspectos de descripción, hemos de decir gráficamente que en el Archivo General de Indias no se hace ni una sola ficha en papel, que el proceso está controlado desde el primer momento, con las ventajas que esto proporciona en muchos aspectos, por ejemplo y esto es muy importante, en un control centralizado de todo lo que es el trabajo descriptivo del Archivo de cara a la normalización, o por ejemplo de cara a la rapidez en el uso de la nueva información disponible para los usuarios.

Después del varios años de duro trabajo, que involucró a todo el personal del Centro y a gran cantidad de personal adicional de entrada de datos, se completó la operación retrospectiva de conversión de todos los instrumentos de descripción existentes y que habían sido desarrollados a lo largo de los dos siglos de historia del Archivo. De forma que hoy no es necesario recurrir a multitud de ficheros, inventarios manuscritos, mecanografiados o impresos... Toda la información descriptiva existente está incorporada en el Sistema de Información y Referencia. De esta forma podemos decir que la información contenida en instrumentos de descripción realizados a lo largo de muchos años ha sido extraída de los mismos y puede verse en forma de registros individualizados en pantalla, aunque siempre conservando sus relaciones contextuales.

Además de la información ya existente, una gran cantidad de "descripción" nueva se ha realizado a lo largo del proyecto y ha sido incorporada directamente al sistema, de forma que buena parte de ella ha sido grabada en soporte informático sin pasar siquiera por la ficha en papel.

Pero a partir del sistema informático pueden obtenerse los tradicionales instrumentos de información en papel. De esa forma se han obtenido inventarios o catálogos impresos correspondientes a Secciones y Series que antes los tenían sólo manuscritos, y además se han impreso otros nuevos de los documentos descritos directamente a través del sistema.

Sin embargo, hemos de insistir en que en lo esencial el trabajo archivístico es el mismo que con anterioridad, aunque realizado con nuevas y más poderosas herramientas. Debemos insistir en este punto: el sistema está específicamente dirigido para atender a las necesidades del archivo y el

trabajo fundamental es el mismo que se realizaba de manera manual. Incluso debemos decir que es más exigente la preparación de documentos, ya que los errores se detectan con más facilidad y los documentos mal preparados y organizados quedan más fácilmente fuera de control. Así por ejemplo, la preparación de los documentos para digitalización ha de ser más cuidada que para la microfilmación.

Este trabajo archivístico comienza con la selección de los documentos a digitalizar. El primer criterio de selección es el de digitalizar únicamente series completas de documentos, no documentos sueltos seleccionados por su interés o por las materias de que tratan. Y en segundo lugar el criterio estadístico (digitalización de las series más consultadas). Están además otros posibles criterios como el estado de organización y descripción de los documentos y su estado de conservación.

Los documentos seleccionados deben ser adecuadamente preparados para su envío a la sala de digitalización: el trabajo puramente archivístico de ordenación de los documentos, legajo a legajo, realizando una nueva descripción de los mismos o revisando la ya existente, colocándolos adecuadamente en carpetas, escribiendo la signatura, etc. Sin una adecuada preparación todo el trabajo posterior será prácticamente inútil.

En resumen podemos decir que el trabajo archivístico sigue siendo el mismo, pero utilizando herramientas más poderosas y rápidas que las tradicionales.

4. Cambios en el sistema informatico

La rapidez con que avanzan las nuevas tecnologías de la información plantean algunos problemas de todos conocidos, que el Archivo General de Indias ha debido abordar de forma decidida.

4.1. Obsolescencia

La obsolescencia del equipamiento informático (físico y lógico) es muy grave en el caso de las tecnologías de la imagen y del almacenamiento óptico, tan nuevas y dinámicas, lo que obliga a prever la necesaria reconversión de los sistemas a no muy largo plazo, y llevan igualmente a la necesidad de una estrategia de "migración" de equipos y software, y de "recopiado" periódico de los datos.

4.2. Sistema abiertos

El sistema que fue diseñado en buena medida con criterios "propietarios"

en la tecnología, ha evolucionado y continua evolucionando hacia sistemas abiertos. Desde el AS-400 y la tecnología Microchanel, única alternativa en los inicios del sistema, hoy están disponibles nuevas versiones en Unix y OS/2 con equipos Pentium, y está avanzada la versión Windows.

4.3. Nuevos soportes de información

La falta de estándares llevó en a la experimentación con discos ópticos WORM, de los que el Archivo tiene en este momento unos 7.000, que hoy están siendo sustituidos en por otros con tecnología CD-ROM.

4.4. Formatos de imagen

La inexistencia también entonces de formatos estándar de imágenes o de algoritmos de compresión, llevó al desarrollo de nuestro propio formato y nuestro propio algoritmo. Ante la aparición de nuevos estándares como el JPEG, hoy el sistema permite la utilización de estas nuevas herramientas, de uso generalizado, aunque de menor calidad que el formato específico desarrollado para el A.G.I..

4.5. Utilización de cámaras digitales

Otro cambio importante es la sustitución de los equipos de escaner de cama plana por Cámaras digitales, más rápidas y mejores para la conservación de los documentos. Con ellas se pueden obtener velocidades de trabajo más cercanas a las habituales con el microfilm, lo que junto con el descenso del coste de los soportes, hace que los presupuestos de digitalización de documentos vayan siendo competitivos con los de este soporte ya tradicional.

4.6. Acceso a distancia

Y por último, aunque el sistema informático fue en principio concebido para su utilización exclusiva dentro del Archivo, se han realizado diversas experiencias y estamos analizando la puesta en marcha de una gran operación que nos permita incorporar al Archivo a las grandes redes de comunicación, a medida que la capacidad de las redes aumente y se hagan realidad las autopistas de la información.

5. Conclusión

La experiencia realizada en los últimos años en el Archivo General de Indias ha sido sumamente significativa en muchos aspectos, de los que no es el menos importante el relacionado con la financiación del proyecto mediante una gran operación de mecenazgo.

Por primera vez se ha conseguido disponer en un Archivo Histórico de un sistema informático integrado capaz de atender a la mayor parte de sus funciones, que lleva funcionando ininterrumpidamente más de cinco años. Por primera vez se ha conseguido disponer de toda la información descriptiva del Archivo incluida en un sistema unificado de información, aprovechando "todos" los instrumentos de información ya existentes. Por primera vez un Archivo Histórico ha podido ofrecer 11 millones de páginas de documentos (en torno al 13% del total) disponible para consulta directa en pantalla, sin recurrir al original.

Una experiencia sumamente interesante que nos abre nuevas vías para incorporación al mundo de las redes digitales y para la entrada del Archivo en la "aldea global", con la de "Sala de Lectura a distancia", o la "teleinvestigación", a las que probablemente llegaremos en un futuro no demasiado lejano. En ella el avance de la tecnología juega a nuestro favor, aunque el trabajo intelectual del archivero sigue siendo la base para que todo tenga la calidad necesaria.

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NORME E RACCOMANDAZIONI SULLA FOTORIPRODUZIONE IN MICROFILM

The lecture enlights the advantages that still exist, in the era of the digital image, to use the microfilm for archival purposes and confirms as appropriate also today the technological choice made some year ago for the ACC Project.

A wide bibliography is added, as well as a complete and updated list of the International Standards on Microfilm Reprography.

Premessa

Il Centro di fotoriproduzione legatoria e restauro degli Archivi di Stato è stato incaricato dall'Ufficio centrale per i beni archivistici di effettuare la duplicazione dei microfilm originali riproducenti documenti della Commissione alleata di controllo. Attualmente il Laboratorio di fotoriproduzione del Centro ha duplicato n. 3920 bobine 16 mm. La duplicazione rappresenta soltanto una fase di un progetto nato su iniziativa dell'Amministrazione archivistica italiana, per la cui descrizione rimando ai relatori competenti. Ricordo soltanto che l'iniziativa è finalizzata a recuperare i documenti della Commissione alleata di controllo e del Governo militare operanti in Italia dal 1943 al 1947, 12 milioni di carte per un totale di circa 6.000 bobine; accenno, inoltre, al fatto che lo stato di conservazione dei documenti, conservati presso la National Archives and Records Administration (USA) ed ivi microfilmati, ha destato, per quanto ho potuto apprendere, alcune preoccupazioni. Infatti, sia le condizioni del supporto in carta, peraltro inevitabilmente disomogeneo per qualità, colore, durabilità e stabilità, sia degli inchiostri, a volte talmente sbiaditi da rendere la scrittura difficilmente leggibile, erano indici evidenti di un processo di degradazione. Lo stato di conservazione ha avuto, pertanto, riflessi sia sui tempi necessari alla preparazione dei documenti, sia sulle modalità di riproduzione, ma ha anche fatto sì che il microfilm assumesse una funzione di "conservazione", aggiuntiva alla finalità originale del progetto che potremmo definire soltanto di "acquisizione". Proprio questo aspetto è, come vedremo, a sostegno oggi della scelta fatta a favore del sistema microfilm per l'acquisizione di una copia dei documenti della Commissione alleata di controllo e del Governo militare.

Categorie d'uso dei microfilm

A proposito dei termini appena impiegati che definiscono due particolari

categorie d'uso del microfilm, ci sembra opportuno qui ricordare a chi non fosse specialista della materia, fatto sempre salvo il rinvio per un commento più competente alle opportune professionalità, che, per quanto mi risulta, generalmente vengono accettate, oltre a quelle sopra citate, le seguenti categorie, anch'esse proposte da A.H. Leisinger[1]: "sicurezza", "pubblicazione", "sostituzione", "riferimento", "amministrazione" e "gestione". Nella letteratura si riscontra anche l'uso di categorie leggermente diverse da quelle qui elencate[2].

Impiego del microfilm

Il microfilm è stato ampiamente utilizzato nel passato per riprodurre documenti di archivio; precedentemente l'alternativa per una riproduzione a costi contenuti era rappresentata soltanto dalla copia elettrofotografica, procedimento inventato da Charles Carlson alla fine degli anni Trenta e successivamente diffusosi ampiamente con l'introduzione sul mercato della copiatrice Xerox 914. È noto, altresì, che il metodo elettrofotografico non ha avuto ampia diffusione per la riproduzione dei documenti di interesse storico ed archivistico, essenzialmente per i giustificati timori relativi ai possibili danni sia alla legatura sia al singolo foglio, derivanti dall'esposizione ripetuta della carta e degli inchiostri alle radiazioni elettromagnetiche e dalla manipolazione. Tali inconvenienti erano praticamente assenti nel sistema microfilm: la produzione di uno o due "master" (uno di sicurezza, uno per la duplicazione) permetteva di ottenere copie per la consultazione senza più dover ricorrere al documento originale, il riproduttore "planetario" evitava di maltrattare la legatura ed i fogli rilegati.

Il microfilm ha così rappresentato per molti anni l'unico modo di ottenere copie di qualità da manoscritti e stampe ad un costo relativamente contenuto, sottraendo così i documenti originali ai danni derivanti da una frequente consultazione. Il microfilm ha rappresentato anche l'unico modo di ottenere una copia con caratteristiche tali da poter eventualmente sostituire il documento, qualora esso andasse accidentalmente perduto o distrutto in seguito a furti, incendi, inondazioni, etc. (microfilm di "sicurezza") o

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[1] A.H. LEISINGER, *Microreproduction of Archives for reference and publication purposes: selected aspects of microreproduction in the United States*, in «Archivum», XLI (1966), pp. 127-150.

[2] B. GILLE, *Esquisse du plan de normalisation pour le microfilmage des archives*, in «Archivum», III (1953), pp. 87-103; E. CALIFANO, *La fotoriproduzione dei documenti e il servizio microfilm negli Archivi di Stato italiani*, Roma 1960, pp. 5-80 (Quaderni della Rassegna degli Archivi di Stato, 5).

venisse deliberatamente eliminato in seguito ad operazioni di scarto (microfilm di "sostituzione")[3].

Oltre alla convenienza economica, il microfilm ha offerto alcuni evidenti vantaggi rispetto ai sistemi tradizionali di riproduzione (stampa tipografica, offset, etc.) quali la non infiammabilità del supporto, la durabilità nell'uso, la stabilità nel tempo, la rapidità di stampa e duplicazione, la facilità di lettura, la consultazione collettiva e simultanea, l'ingombro ridotto, la facilità di trasporto e di spedizione[4]; sono questi vantaggi, in fin dei conti, che hanno reso così importanti i programmi di fotomicroriproduzione negli Archivi di Stato allo scopo di rendere le informazioni custodite nei loro depositi e non pubblicate con i metodi a stampa, facilmente ed economicamente accessibili. Il microfilm può essere genericamente considerato una forma di pubblicazione o può, in ogni caso, essere utilizzato a questo scopo; del resto, ampia è stata la diffusione di pubblicazioni in microcopia di periodici, quotidiani, archivi bibliografici e serie documentarie, facilitata peraltro anche dalla possibilità di ridurre ulteriormente i costi di pubblicazione con l'impiego di pellicole diazo o vescicolari.

La situazione oggi è diversa. È sotto gli occhi di tutti la diffusione straordinaria di un diverso tipo di pubblicazione, diverso dalla stampa tradizionale e diverso dal microfilm stesso: la pubblicazione in CD. Lascio agli specialisti della nuova tecnologia la valutazione dei vantaggi e degli eventuali svantaggi della registrazione elettronica dell'immagine; cercherò soltanto di illustrare brevemente quelli che a mio giudizio restano, tuttavia, elementi importanti che rendono il microfilm ancora attuale per le esigenze degli Archivi statali.

L'immagine microfilm è una fotografia: la sua tecnologia (materiali, attrezzature) deriva, pertanto dall'evoluzione di una scienza che, praticamente, risale nelle sue prime realizzazioni, agli inizi della prima metà del secolo scorso. Oltre 150 anni ci separano, quindi, dalle prime immagini a risultati eccezionali per quanto riguarda le caratteristiche e la qualità dell'immagine (elevato potere risolutivo, fedeltà dei colori etc.) nonché delle attrezzature. Ciò si è verificato, però, sempre o quasi sempre senza soluzione di continuità, rendendo così facilmente fruibili oggi anche tutti i prodotti del passato. Non solo: l'elettronica stessa ha previsto la possibilità di acquisire l'immagine fotografica su CD rendendone possibile l'archiviazione, la ricerca, la consultazione, l'elaborazione e la stampa con sistemi, appunto, elettronici.

La fotografia è una scienza, risultato di un numero ormai grandissimo di

[3] D.P.C.M. 11 sett. 1974, *Norme per la fotoriproduzione sostitutiva dei documenti di archivio e di altri atti delle pubbliche amministrazioni*, in G.U., 25 nov. 1974, n. 306.

[4] E. CALIFANO, *La fotoriproduzione...* citata.

ricerche teoriche e sperimentali documentate dalla vastissima bibliografia in questa materia. È opportuno sottolineare che, se questo non bastasse per rendere affidabile il prodotto, i tanti decenni trascorsi dalla comparsa delle prime fotografie sono lì a provarne la stabilità nel tempo. Alcune di esse sono ingiallite, altre sono leggermente sbiadite, ma molte altre ancora sono rimaste praticamente inalterate. Le più danneggiate possono, nella peggiore delle ipotesi, essere ancora riprodotte, in qualche caso "restaurate".

Per quanto riguarda il microfilm in particolare, vorrei sottolineare un elemento che, a mio avviso, merita di essere tenuto nella dovuta considerazione quando questo sistema viene posto a confronto con quello elettronico: l'immagine fotomicrografica è comunque leggibile anche semplicemente con l'ausilio di un sistema elementare, una sorgente di luce ed una lente di ingrandimento o proiezione. All'immagine elettronica, invece, si ha accesso esclusivamente con un mezzo di lettura elettronico, mezzo che potrebbe, in condizioni limite, anche non essere disponibile; è per questo motivo, oltre che gli interrogativi che tuttora persistono sulla stabilità nel tempo del CD, che mi sembrerebbe rischioso affidare alla memoria futura atti di importanza storica ed archivistica esclusivamente a supporti elettronici. Permane, del resto, l'esigenza di disporre di copie di "sicurezza" delle serie archivistiche, copia che, per definizione, deve sia avere caratteristiche di leggibilità, ininfiammabilità e stabilità (requisiti che il microfilm offre a costi relativamente contenuti) sia la possibilità di essere lette anche senza l'ausilio di apparecchiature che potrebbero tra l'altro non essere più disponibili. Tale affidabilità è dovuta, come già detto, alla vasta esperienza e bibliografia disponibile in materia, ma è data anche e, forse, soprattutto dall'esistenza di una normativa specifica a livello internazionale prodotta e pubblicata dall'ISO; alle norme ISO si aggiungono quelle nazionali (UNI, BSI, DIN, AFNOR, ANSI) nonché leggi, decreti legge, raccomandazioni e circolari emanate dai singoli Stati.

Norme internazionali sulla riproduzione microfilm

In uno studio Ramp[5] J.B. Rhoads presenta un elenco di norme ISO sulla reprografia suddivise in cinque gruppi principali: materiali, leggibilità, formato e disposizione dell'immagine, riproduzione di particolari tipi di documenti e lessico. In un altro studio Ramp[6] M. Roper riferisce sui Paesi che hanno ema-

[5] J.B. RHOADS, *The applicability of UNISIST guidelines and ISO international standards to archives administration and records management: a RAMP study*, Paris, Unesco, 1982.

[6] M. ROPER, *Directory of National Standards Relating to Archives Administration and Records Management a Ramp Study*, Paris, Unesco, 1986.

nato norme sulla reprografia inerenti le specificità conforme, le caratteristiche ed i metodi di saggio, le operazioni reprografiche, le attrezzature e la validità legale delle riproduzioni. Tenuto conto anche di questi studi, ho ritenuto opportuno suddividere e raccogliere in nove gruppi le norme internazionali pubblicate dall'ISO:

1. autorizzazione alla fotoriproduzione
2. divieto di riproduzione
3. validità legale delle microscopie
4. disposizione e preparazione dei documenti
5. pagine di titolo, introduzione, tavola del contenuto, indici, liste particolari e simboli
6. specifiche, caratteristiche, uso e saggio dei materiali
7. attrezzature
8. conservazione ed ispezione
9. lessico.

Le norme ISO, così suddivise, sono raccolte nell'elenco in Appendice. Per la compilazione dell'elenco è stato consultato il *Catalogo ISO 1995, l'ISO Standards Handbook-Documentation and Information* (1988) e l'*ISO Standards Handbook 26-Photography* (1984). Oltre alle norme sono state riportate alcune proposte in bozza (*DP*) e bozze di norme internazionali *(DIS)* del TC 171. Alcune norme, draft proposal e draft standards vengono riportate più di una volta in gruppi differenti.

Da quanto risulta dal Catalogo ISO 1995 (quello del 1996 non era ancora in visione presso la sede dell'UNI di Roma al momento della stesura di questa relazione) non esistono norme internazionali sull'autorizzazione alla fotoriproduzione e sul divieto di riproduzione, mentre esiste la norma ISO/TR 10200-1990 sullo stato legale delle microforme. Per tutte le altre voci, invece, sono previste raccomandazioni ISO, numerose nella maggior parte dei casi. Non si può in questa sede ovviamente prendere in considerazione ogni singola norma. Vogliamo, però, evidenziare che nell'elenco ho introdotto anche norme non specifiche per la fotoriproduzione in microfilm, ma che comunque ritengo utili per la sua corretta esecuzione. Ho tralasciato di proposito le raccomandazioni sui prodotti chimici per fotografia raccolte nelle sezioni 37.040.30 *(Image Technology-Photographic Chemicals)* del Catalogo ISO, al quale rimando per questo argomento. Ritengo qui sufficiente menzionarne la pubblicazione, che logicamente completa l'argomento in oggetto stabilendo specifiche accurate anche per quanto riguarda i materiali di trattamento delle pellicole.

Appare sufficientemente chiara l'attenzione che l'*International Standard Organisation* ha riservato alla fotografia in genere ed alla riproduzione in microfilm in particolare. Ciò premesso, ci sembra opportuno soffermarci sulle norme raccolte nei gruppi 6. (specifiche, caratteristiche, uso e saggi dei materiali) ed 8.

(conservazione ed ispezione) dell'elenco. Tali norme forniscono esaurienti raccomandazioni sulle caratteristiche chimico-fisiche delle pellicole, sul loro trattamento e sulla loro conservazione allo scopo di assicurare un prodotto resistente all'uso e stabile nel tempo. Non mancano specifiche neppure per quanto riguarda le caratteristiche per gli involucri ed i contenitori, né le condizioni termoigrometriche di conservazione. È oggi, pertanto, possibile reperire con facilità sul mercato non solo pellicole, prodotti, attrezzature corrispondenti alle raccomandazioni ISO, ma anche materiali (involucri e contenitori) per la conservazione certificati. Tutto questo permette di soddisfare il requisito della *"permanenza"* richiesta ad una riproduzione di "sicurezza"; la riproduzione di sicurezza ha, infatti, come già accennato in precedenza, lo scopo di proteggere serie archivistiche di grande valore ed importanza dal rischio di perdere l'informazione in esse contenuta. Caratteristiche di permanenza sono richieste anche alle microforme di "conservazione" ed a quelle di "sostituzione"; quando la fotoriproduzione per "memoria" persegue anche lo scopo di conservazione e quando le microforme di "complemento", per "pubblicazione" o ad "uso scientifico" devono essere utilizzate a scopo di sicurezza o conservazione, anche in questi casi il microfilm assume un valore permanente. Quando la "permanenza" o stabilità a tempo indeterminato rappresenta un requisito irrinunciabile, e ciò evidentemente si verifica spesso, il microfilm costituisce ancora attualmente un sistema economico di riproduzione realisticamente utilizzabile, fatta salva la possibilità di trasferimento dell'immagine su un sistema elettronico per una più facile e rapida consultazione, riservando al microfilm originale la funzione di preservare.

Non è lecito a questo punto tacere, però, alcuni elementi che l'esperienza ha dimostrato essere punti critici del sistema microfilm; non mi riferisco ovviamente al maggior ingombro rispetto al CD, né alla ricerca e consultazione certamente più lente rispetto a quest'ultimo. Tali aspetti, infatti, diventano marginali quando il requisito fondamentale è la sicurezza e possono essere facilmente superati, come appena accennato, da un sistema misto: il microfilm per la conservazione a lungo termine, il CD per la ricerca e la consultazione. Mi riferisco piuttosto al ruolo svolto dall'operatore. La stabilità delle pellicole fotografiche non dipende soltanto dalle sue caratteristiche intrinseche, caratteristiche del resto assicurate dalla normativa internazionale e dai produttori, ma anche dall'idoneità del trattamento: sviluppo, fissaggio e lavaggio. In questa fase l'operatore ha un ruolo determinante: elimina le soluzioni "esauste", le sostituisce con quelle efficienti, controlla le condizioni operative della sviluppatrice automatica (velocità, temperatura), controlla l'efficienza del lavaggio etc. Egli può realizzare una riproduzione, oltre che perfettamente leggibile in ogni dettaglio, anche stabile per 100 anni o più, oppure scarsamente leggibile e deperibile in pochi decenni per l'insorgere di macchie, l'ingiallimento del-

l'immagine e il successivo sbiadimento. Il microfilm prodotto deve essere sempre, pertanto, sottoposto ad un controllo di qualità con la finalità di verificarne la corrispondenza ai requisiti raccomandati dall'ISO (leggibilità, stabilità). I criteri di qualità e controllo sono esaurientemente indicati nelle norme ISO[7]. In accordo con la necessità esposta, l'Ufficio centrale per i beni archivistici ha predisposto nel 1988 una "Normativa per la microfilmatura di sicurezza in bianco e nero dei documenti d'archivio" (circ. n. 12/88) (3) del 1° febbraio 1988) che fino ad oggi non ha richiesto modifiche o aggiornamenti di particolare rilievo.

LUCIANO RESIDORI
Centro di fotoriproduzione, legatoria e restauro

APPENDICE

INTERNATIONAL STANDARDS ON MICROFILM REPROGRAPHY

1. *Permission for photoreproduction* no standards

2. *Copyright* no standards

3. *Legal validity of microforms*

-ISO 10200- 1990, Micrographics-A survey of the legal status of microforms

4. *Arrangement and preparation of documents*

-ISO 6428-1982, Technical drawings-Requirements for microcopying

-ISO 5963-1985, Documentation-Methods for examining documents, determining their subjects, and selecting indexing terms

[7] L. RESIDORI-D. RUGGIERO-F. SANTUS, *La microfilmatura in bianco e nero dei documenti di archivio,* in CENTRO DI FOTORIPRODUZIONE, LEGATORIA E RESTAURO, *Le scienze applicate nella salvaguardia e nella riproduzione degli archivi,* Roma 1989, pp. 171-183 (Quaderni della Rassegna degli Archivi di Stato, 56); *Paper Packaging for the Long-term Preservation of Photographic Plates,* in «Restaurator», XV (1994), pp. 79-935; M. ROPER, *Directory of national standards relating to archives administration and records management: a RAMP study,* Paris, Unesco, 1986; M. DUCHEIN, *Obstacles to the access, use and transfer of information from Archives: a RAMP study,* Paris, Unesco, 1981; G. WEILL, *The admissibility of microforms as evidence: a RAMP study*, Paris, Unesco, 1981; *Regolament*, National Archives and Records Administratio, 30 CFR 1b. XII (7/1/1986), pp. 590-594.

-ISO 7144- 1986, Documentation-Presentation of thesis and similar documents

-ISO 5966-1982, Documentation-Presentation of scientific and technical reports

-ISO 10196- 1990, Micrographics-Reccomendations for the creation of original documents

5. *Title pages introduction, table of contents, indexes. special lists and symbols*

-ISO 4087- 1991, Microfilming of newspapers on 35 mm microfilm for archival purposes

-ISO 5123- 1984, Documentation-Headers for microfiche of monographs and serials

-ISO 999- 1975, Documentation-Index of publication

-ISO 2145- 1978, Documentation-Numbering of divisions and subdivisions in written documents

-ISO 2146-1988, Documentation-Directories of libraries, archives, information and documentation centres, and their data bases

-ISO 5122-1979, Documentation-Abstracts sheets in serial publications

-ISO 5963-1985, Documentation-Methods for examining documents, determining their subjects, and selecting indexing terms

-ISO 7275-1985, Documentation-Presentation of title information of series

-ISO 4-1984, Documentation-Rules for the abbreviation of title words and titles of publications

-ISO 9878-1990, Micrographics-graphical symbols for use in microfilming

-ISO 4087-1981, Microfilming of newspapers for archival purposeon 35 mm microfilm

-(Wl 2-034), Microfilming of cartographic matter

-ISO 6829-1983, Flowchart symbols and their use in micrographics

6. *Specifications. characteristics. use and testing of materials*

6.1 *Materials*

-ISO 4330-1994, Photography-Determination of the curl of photographic film

-ISO 4331-1977, Photography-Processed photographic film for archival records-Silver-gelatin type on cellulose ester-base-Specifications

-ISO 4332-1977, Photography-Processed photographic film for archival records-Silver-gelatin type on poly(ethylene terepthalate)base-Specifications

-ISO 5769-1984, Photography-Processed films-Method for determining lubrication

-ISO 6077- 1993, Photography-Photographic films and papers-wedge test for brittleness

-ISO 6221 - 1991, Photography-Films and papers-Determination of the dimensional change characteristics

-ISO 830-1983, Photography-Safety photographic films other than motion picture films-Materials specifications

-ISO 543-1990, Photography-Photographic films-specifications for safety films

-ISO 1116-1975, Microcopying-16 mm and 35 mm microfilms, spools and reels

-ISO 2708-1980, Micrographics-Transparent A6 size microfiche of variable division-Image arrangements A and B

-ISO 3272/1994, Microfilming of technical drawings and other drawings office documents-Part II: Quality criteria and control of 35 mm silver gelatin microfilms

-ISO 6343-1981, Micrographics-Unitized microfilm carrier (aperture card)-Determination of adesion of protection sheet to aperture adhesive

-ISO 3272/III-1975, Microcopying of technical drawings and other drawing office documents-Part III: Unitized 35 mm microfilm carriers

-ISO 6342- 1993, Micrographics-Aperture cards-Method of measuring thickness of builduparea s

-ISO 1048-1991, Photography-Exposed roll films-Identification - ISO 10602-1993. Photography-Processed silver-gelatin type black-and-white film-Specification for stability

-ISO 8776-1988, Photography-Photographic film-Determination of folding endurance

6.2 *Film treatment*

-ISO 417- 1991, Photography-Determination of thiosulphate and other related chemicals in processed photographic materials - Methods using iodine-amylose, methyllene blue and silver sulphide

-ISO 2803-1974, Photography-Silver-gelatin type microfilms-Processing and storage for archival purposes

-ISO 5769-1984, Photography-Processed films-Method for determining lubrication

-ISO 4331- 1986, Photography-Processed photographic black-and-white film for archival records-Silver gelatin-type on cellulose ester base-Specifications

-ISO 4332-1986, Photography-Processed photographic black-and-white film for archival records-Silver gelatin-type on poly(ethylene terephthalate)base-Specifications

-ISO 10602-1993. Photography-Processed silver-gelatin type black-and-white film-Specification for stability

6.3 *Optical quality*

-ISO 435-1975, Documentary reproduction-ISO conventional typographical character for legibility tests (ISO character)

-ISO 446- 1991, Micrographics-ISO character and ISO test chart n. 1 - Description and use

-ISO 3334-1989, Micrographics-ISO resolution test chart N. 2-Description and use

-ISO 5/1-1984, Photography-Density measurements-Part I:terms, symbols and notations

-ISO 5/2-1991, Photography-Density measurements-Part II: Geometric conditions for transmission density

-ISO 5/3-1995, Photography-Density measurements-Part III: Spectral conditions

-ISO 5/4-1995, Photography-Density measurements-Part IV: Geometric conditions for reflection density

-ISO 6200-1990, Micrographics-First generation silver-gelatin microforms of source documents-Density specifications

-ISO 6328-1982, Photography-Photographic materials-Determination of ISO resolving power

-ISO 2707-1980, Micrographics transparent A6 size microfiche of uniform division-Image arrangements N. 1 and N. 2

-ISO 2708-1980, Micrographics transparent A6 size microfiche of variable division-Image arrangements A and B

-ISO 4087-1991, Micrographics-Microfilming of newspapers for archival purposes on 35 mm microfilm

-ISO 5126- 1980, Micrographics-Computer output microfiche (COM)-Microfiche A6

-ISO 8126-1986, Micrographics-Diazo and vesicular films:visual density specifications

-ISO 3334-1989, Micrographics-ISO resolution test chart N. 2-Description and use

-(WI 4-030), Micrographics-ISO microtest chart N. 1 -Description and use for checking a reading apparatus

-(WI 4-031), Micrographics-ISO microtest chart N. 2-Description and use for checking a reading apparatus

-(WI 4-039), Method for measuring the quality of microforms produced by rotary cameras

-ISO 10550-1994, Micrographics-Planetary camera systems-Test target for checking performance -(WI 2-048), Micrographics-Enlargements from 35 mm microfilm-Quality criteria and control

-ISO 3272/2: 1994, Microfilming of technical drawings and other drawing office documents-Part 2: Quality criteria and control of 35 mm silver gelatin microfilms

-ISO 8514/1-1992, Alphanumeric computer output microforms-Quality control-Part 1: Characteristics of the test slide and test data

-ISO 8514/2- 1992 Alphanumeric computer output microforms-Quality control-Part2: Method

6.4 *Microforms size and image arrangement*

-ISO 1116-1975, Microcopying-16 mm and 35 mm specifications, spoon and reels

-ISO 2707-1980, Micrographics-Transparent A6 size microfiche of uniform division-Image arrangements N. 1 and N. 2

-ISO 2708-1980, Micrographics-Transparent A6 size microfiche of variable division-Image arrangements A and B

-ISO 3272/1-1983, Microfilming of technical drawings and other drawing office document-Part I:Operating procedures

-ISO 4087- 1991, Microfilming of newspapers microfilm on 35 mm for archival purposes

-ISO 5126-1980, Micrographics-Computer output microfiche (COM)-Microfiche A6

-ISO 6197/1- 1980, Microfilming of press cuttings-Part 1: 16 mm silver gelatin-type roll microfilm

-ISO 6197/2-1985, Microfilming of press cuttings-Part 2: A6 size microfiche

-ISO 6234-1981, Bank operations-Authorized signature lists and their representations on microfiche

-ISO 6197/2 (Wl 3-006.02), Microfilming of press cuttings- Part II: A6 size microfiche

6 5 *Duplicating*

-ISO 3272/4-1994, Microfilming of technical drawings and other drawing office documents-Part 4: Microfilming of drawings of special and exceptional elongated sizes

-ISO 4087-1991, Microfilming of newspapers for archival purposes on 35 mm unperforated microfilm

-ISO 6199-1991, Microfilming of documents on 16 mm and 35 mm silver gelatin-type microfilm-Operating procedures

-ISO 6148-1993, Photography-Film dimensions-Micrographics -ISO 8217/1 - 1989, Micrographics-A6 size microfilm jackets-Part I :Five channel jacket for 16 mm microfim

-ISO 9923-1994, Micrographics-Transparent A6 microfiche-Image arrangements

-(WI 2-049), Micrographics-35 mm copy and duplicating test procedure

7. *Equipment*

-(Wl 4-031), Micrographics-ISO microtest chart N. 2-Description and use for checking a reading apparatus

-ISO 10197- 1993, Micrographics-Microform reader printers

-ISO 10198-1994, Micrographics-Rotary camera for 16 mm microfilm-Mechanical and optical specifications

-ISO/DP 10550 (WI 4-047), Test target for checking the quality of microforms produced with planetary camera

-ISO 6198-1993, Micrographics-Readers for transparent microforms-Performance characteristics

-ISO 7565-1993, Micrographics-Readers for transparent microform-Measurement of characteristics

-ISO 3272/3: 1975, Microcopying of technical drawings and other drawing office documents-Part 3: Unitized 35 mm microfilm carriers

8. *Storage and inspection*

-ISO 2803-1974, Photography-Silver-gelatin type microfilms-Processing and storage for archival purposes

-ISO 5466-1992, Photography-Processed safety photographic films-Storage conditions

-ISO 9718- 1991, Photography- Processed vesicular photographic fillm-Specification for stability

-ISO 10214-1991, Photography-Processed photographic materials-Filing enclosures for storage

-ISO 10331-1991, Photography-Unprocessed photographic films and papers-Storage practice

-ISO 10602-1993. Photography-Processed silver-gelatin type black-and-white film-Specification for stability

9. *Vocabulary*

-ISO 6196/1-1993, Micrographics-Vocabulary-Part 01: General terms

-ISO 6196/2-1993, Micrographics-Vocabulary-Part 02: Image position and method of recording
-ISO 6196/3-1983, Micrographics-Vocabulary-Part 03: Film processing
-ISO 6196/4-1987, Micrographics-Vocabulary-Part 04: Materials and packaging
-ISO 6196/5-1987, Micrographics-Vocabulary-Part 05: Quality of images, legibility inspection
-ISO 6196/6-1992, Micrographics-Vocabulary-Part 06: Equipment
-ISO 6196/7-1992, Micrographics-Vocabulary-Part 07: Computer micrographics
- (WI 5-057), Micrographics-Vocabulary-Part 08: Use.

MOVING TOWARDS NEW TECHNOLOGIES

Kodak was the partner company for the ACC Project both in Washington DC and in Rome, assisting for the standards application, filming quality, hardware and software.

The lecture illustrates, with the aid of several slides, the possible migration of the ACC microfilm to a digital carrier.

The Imagelink system is a technological bridge between the analogical and the digital media and would make accessible the ACC records to the users through both the microfilm media and the optical disk.

Il progetto ACC è stato uno dei progetti fondamentali seguito da Kodak divisione Business Imaging Systems (BIS) nel settore della Pubblica Amministrazione. Come ovvio è stato affrontato con la tecnologia a disposizione negli anni '80, utilizzando appieno i suggerimenti che sono derivati dall'esperienza dei responsabili del progetto in Italia. Lo scopo della trattazione che oggi faremo è quello di proporre una evoluzione tecnologica del progetto derivante dallo sviluppo del sistema della divisione BIS.

La divisione BIS di Kodak opera nel mercato della archiviazione dei documenti da molti anni. A livello mondiale più di 20.000 organizzazioni utilizzano i sistemi del BIS per le proprie esigenze di gestione immagini che vanno dalle applicazioni per il protocollo, alle cartelle cliniche alla microfilmatura degli assegni. Molti di queste organizzazioni utilizzano sistemi di gestione basati su microfilm, al pari dell'archivio ACC.

A partire dall'ultimo periodo degli anni '80 e durante gli anni '90 Kodak ha cominciato ad immettere sul mercato dell'archiviazione prodotti che utilizzano media complementari al microfilm come i dischi ottici ed i CD-R. L'utilizzo della parola complementari non è casuale, infatti l'approccio seguito da Kodak è stato quello di vedere l'evoluzione tecnologica dei media a disposizione per le problematiche di archiviazione come uno strumento di miglioramento delle procedure utilizzabili e non soltanto come splendido esempio di cosa può produrre la tecnologia, sull'onda della rapidissima evoluzione che si vede ad esempio nel mondo della informatica individuale.

La parola chiave usata da Kodak nel periodo descritto è stata IMAGELINK™, espressione che ha caratterizzato una piattaforma tecnologica ponte tra l'analogico ed il digitale. Lo sviluppo dei prodotti di questa piattaforma ha prodotto strumenti in grado di migliorare l'utilizzo di media analogici rendendoli del tutto simili al media digitale.

In particolare il sistema di gestione immagini Imagelink Business Solution PC-Plus (IBS) evoluzione del sistema KAR100 su cui si basa l'applicazione di ACC, consente l'utilizzo contestuale del microfilm e dei dischi ottici in modo trasparente per l'utente. In questo modo il ricercatore di immagini quando sta

consultando un documento sul video del suo PC non ha la percezione se esso gli sia pervenuto da un disco ottico oppure da una bobina microfilm. Questo è quello che si chiama "Indipendenza dal media di archiviazione" per cui si possono ipotizzare tre fasi nel ciclo di vita delle informazioni che corrispondono a tre media differenti: il magnetico, che garantisce la massima velocità di accesso alle informazioni nel periodo in cui esse vengono ricercate più frequentemente; il disco ottico CD-R per la fase di gestione delle eccezioni, in cui il tempo di accesso alle informazioni può essere misurato in secondi e non in millesimi di secondo ed il microfilm per la storicizzazione dell'archivio in cui le ricerche sono non frequenti ed i tempi di accesso alle informazioni possono essere nell'ordine dei minuti. È quindi palese che IBS utilizza tecnologia e media "State of the Art" ma consente anche il mentenimento di archivi pregressi garantendo la protezione degli investimenti fatti in passato. Il software di gestione, ed in particolare il database, è in grado di riconoscere la gerarchia del media e di proporre una lista di elementi trovati, a fronte di una ricerca, assolutamente indipendente dal media di residenza dell'immagine ricercata. In caso di immagine su microfilm essa viene introdotta sul network dei computer tramite il processo di digitalizzazione del microfilm effettuato dal lettore stampatore Imagelink Digital Workstation 2000 (IDW2000).

Altra caratteristica del software IBS è la modularità che consente di implementare le varie funzionalità in base ai bisogni del periodo, consentendo di fasare gli investimenti in tecnologia in base alle reali esigenze.

COSMO PEPE
Società Kodak Italia

Kodak digital science

KODAK

Sistema di Gestione Immagini

IMAGELINK™
BUSINESS
SOLUTIONS
PC-PLUS

Kodak digital science

Imagelink Business Solutions Pc-Plus

- ***Architettura Aperta***
- ***Indipendenza dal media di archiviazione***
- ***Architettura Client-Server***
- ***Software indipendente dall'hardware (i286, i386, i486, iP)***
- ***Supporto di cablaggi Ethernet e Token Ring***

Kodak digital science — Imagelink Business Solutions Pc-Plus

Network Software : Novell NetWare 3.XX
IBM Lan Server
MS Lan Manager

Client Software : MS - Dos 5.0 o superiore
MS - Windows 3.1

Kodak digital science — Imagelink Business Solutions Pc-Plus

Modularità del Software
"Buy what you Need"

Scalabilità del livello d' accesso
Monoutenza
Lan 4 utenti
Lan Upgrade di 4 utenti fino ad "enterpise"

Nelle configurazioni Lan gli accessi
sono regolati in concorrenza

Kodak digital science — Imagelink Business Solutions Pc-Plus

Software " Buy what you Need"

Il Kernel del software offre il

GENERATORE DI APPLICAZIONI PARAMETRICO

che consente la scelta dei moduli software

in base alle esigenze applicative

Ad esempio : Moduli per scansione interattiva
Modull per scansione Batch
Moduli per la gestione di scanner piani
Moduli per la gestione di scanner rotativi

Kodak digital science — Imagelink Business Solutions Pc-Plus

INDIPENDENZA DAL MEDIA DI ARCHIVIAZIONE

IBS/PC-PLUS è in grado di gestire immagini archiviate su:

DISCO MAGNETICO (media di passaggio)

CD-R (ISO 9660 Archiviazione Permanente)

MICROFILM (Archiviazione Permanente)
Il microfilm viene gestito da IBS/PC-Plus al pari dei media digitali. L' immagine richiesta viene digitalizzata e quindi inoltrata sul Pc del richiedente.

Imagelink Business Solutions Pc-Plus

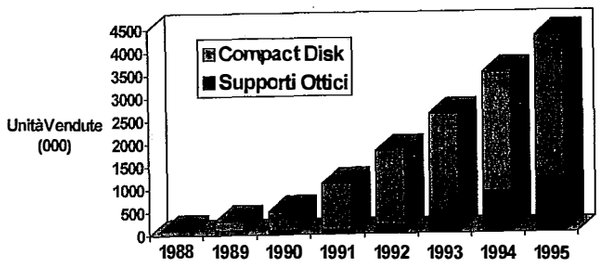
INDIPENDENZA DAL MEDIA DI ARCHIVIAZIONE

IBS / PC - PLUS offre quindi la gestione delle Immagini utilizzando tecnologia "State of the Art", ma consente anche il mantenimento di archivi pregressi garantendo la protezione degli investimenti fatti in passato.

Imagelink Business Solutions Pc-Plus

PERCHE' IL CD-R

IL MERCATO DEI CD COME PORZIONE DELL'OTTICO

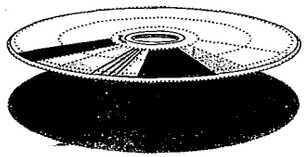


Imagelink Business Solutions Pc-Plus

PERCHE' IL CD-R

VANTAGGI TRADIZIONALI DEL CD

- *Durata nel Tempo*
- *Distribuibilità*
- *Capacità*
- *Standard*



Imagelink Business Solutions Pc-Plus

ALCUNE CARATTERISTICHE OFFERTE DAL KERNEL

IBS/PC-PLUS INFORMATION SYSTEM

Generatore di Applicazioni Parametrico

Gestione della sicurezza

Gestione di ogni "Oggetto" dell'ambiente MS-Windows : Dati (EXCEL, WINWORD), Suoni (Wav), Video (Avi), ecc

Gestione del Database di tipo VSAM

API

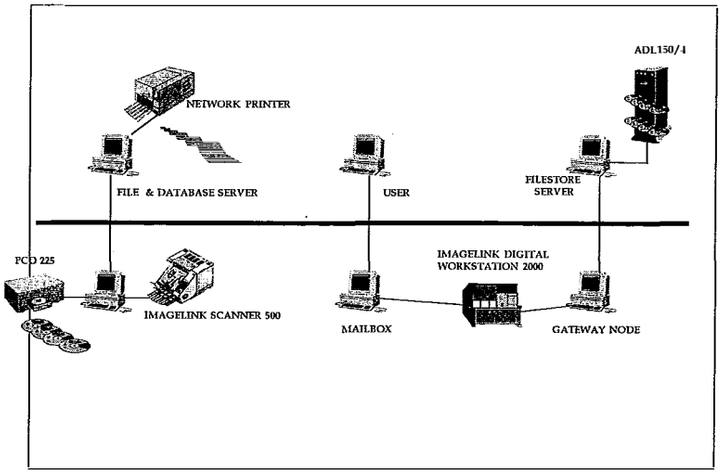
Kodak digital science Imagelink Business Solutions Pc-Plus

ALCUNI MODULI SOFTWARE OFFERTI

MODULO SOFTWARE PER GESTIRE LO "SPOOL";
MODULO SOFTWARE PER LA LETTURA "OCR";
MODULO SOFTWARE PER LA MASTERIZZAZIONE DEI CD-R;
MODULO SOFTWARE PER LA DIGITALIZZAZIONE DEL MICROFILM;
MODULO SOFTWARE PER LA GESTIONE DI CD-R JUKE-BOX
6 SLOT 1 PLAYER 4X
18 SLOT 3 PLAYER 4X
150 SLOT 4 PLAYER 4X;
MODULO SOFTWARE PER LA GESTIONE DELLA "CASELLA POSTALE"

Kodak digital science *Imagelink Business Solutions Pc-Plus*

UNA CONFIGURAZIONE



THE INDEX AND ITS PLACE IN AN ARCHIVAL FINDING AIDS SYSTEM

L'intervento intende sottolineare l'importanza che ha l'indice nel contesto di un sistema di strumenti di ricerca archivistici. Particolare attenzione è rivolta alla necessità di adottare standard sia per la descrizione che per il trattamento informatico.

Sono quindi analizzate la funzione che ha l'indice, la struttura di un sistema di strumenti di ricerca archivistici, sia tradizionali che automatici e le problematiche della standardizzazione.

Main theme

The objective of this paper is to put the attention upon the importance of the index in the context of the archival finding aids system, and the application of both archival descriptive standards, and computerization standards on it.

The index that gives access to the microfilm or other mean of duplication is not just an isolated tool for retrieval, but should be integrated with other finding aids that are in place and give access to records. All together these finding aids create a system through which an archives communicates with its customers. It may be obvious that such a system should meet high quality requirements.

Consequently the development of this system, including a variety of finding aids, is too important to rely completely upon vendors, in particular when they come up with proprietary software.

Sections in the Report

1) The function of the Index in a microfilm or other imaging system
2) The structure of an archival finding aids system
3) Standardisation Issues
4) Automation of finding aids systems
5) Conclusions

1. The function of the Index

Basically the function of the Index is simply: to retrieve images. The better the index is, the faster the user may retrieve the image he or she wants to look at. Many traditiona microfilm applications did not need an index. Many European archives hold series of microfilms of birth, marriage, and death registers. A label on the cassette tells the user what registers are on the reel.

The documents are filmed in chronological order, and the user may browse through the film to identify the document he wants. Looking more in detail, however, we might discover that even before taking the reel, some kind of finding aid has been used to identify it, and to find out the date of birth or marriage, or death. These indexes are just not directly linked with the microfilm.

However, the more random the documents are stored on the medium, the more critical is the tool that helps to find the document. Digital imaging systems, such as the application developped for the Archivo General de Indias, Sevilla, Spain, are even completely dependent of an index, and always an automated one. Also modern microfilm applications make use of automated indexes for fast retrieval. The higher the quality of the index, the more effective the retrieval is, and consequently the happier the user, our customer, will be. Quality may be expressed in terms of reliability, preciseness, level of detail, user friendliness, but also in terms of the systems costs.

2. The Finding Aids System

Microfilms and other Image applications are by far not the only sources of information that an archives keeps. Archival documents are usually kept and made available for use in paper form. A variety of finding aids supports the archives customers to get access to these documents.

I consider the whole of finding aids of an archives as being a system: a number of inter-related components. To be more precise: it is an information system. The purpose of a finding aids system is to provide access to different holdings, consisting in both original records, and in duplicated records.

A typical paper based finding aids system of an archive may consist in the following main components:

a) Guides, etc.: systematic descriptive lists of the holdings, usually at the fonds and collection level.
b) Inventories (also called catalogue in some traditions): systematic descriptive lists of the component parts of a fonds, according to arrangement, such as series, subseries, and the pieces in which the series consist, such as volumes, registers, files, etc.
c) Indexes and other instruments that gives detailed information about the contents of single pieces, for precise retrieval of documents, or specific pages in registers. Examples are indexes on personal or geographical names, subject indexes, but also instruments such as calendars.

Every archives may have developed and kept its own, proprietary finding aids system, customised according to its customers needs, but I do not think

that the various types of systems fundamentally differ.

In North-America one may find series descriptions in dedicated finding aids, separated from the file lists. Basically, however the model is te same as in some European countries, including Italy and the Netherlands, where series descriptions and item descriptions are integrated in the inventory. Each archives puts emphasis on a specific part, such as on the inventory in Italian and Dutch practice.

The common characteristic is the interrelationships: the different finding aids are connected, both vertically (different levels of descriptions), as horizontally (different fonds).

In conclusion: Since indexes on microfilms and other imaging systems are particular finding aids on particular holdings, they form a part of the finding aids system of an archives.

3. Standardisation

The success, as well as the life-span of microfilm and digital imaging applications relie upon standards, as has been pointed out in various reports of this seminars. Standardisation supports the long term maintenance of applications, and enhances consequently the life span.

Similarly, the descriptive part of an image application, might be subject of standardisation as well. I would like to pay some attention to this area, being a specific archival field of interest.

The methods how archives describe their holdings are based on widely accepted archival principles. Yet, many differences between archival traditions might be identified all over the world. During the last five or six years progression has been booked in the field of standardisation of archival description, mainly thanks to the work of the International Council on Archives ad hoc Commission on Descriptive Standards. The draft International Standards for Archival Description (General) is based on the concept of levels of description, such as fonds, series, and item. The rules identify 26 data elements for description, applicable on each level. The ISAD(G) rules focus mainly on the higher levels of description: fonds and series. The index level is hardly subject of standardisation, except from authority control[1]. The place of the index, however, in the ISAD(G) concept, is clearly defined, as is its connection with the higher levels.

Automation of finding aids calls for standardisation, to improve the quality, to enable exchange of information, and to support maintenance. More than paper based finding aids an automated system requires maintenance.

4. Automation

All over the world archivists are computerising their finding aids systems. Since the hardware is generally within the financial scope of many archives, and powerful software is available at reasonable costs, many applications have been developed; and archival database created.

After an initial stage of experiments, and development of mainly local applications, archives reach the stage of maturity. Intra- and inter-institutional networks are set up. This evolution calls for a structured approach, based on common standards. The existing finding aids system should be re-formatted into an architecture for an automated retrieval system. The ISAD rules are an important step into the new stage. As a next step the ICA Committee on Information Technology works on a generic blueprint for a descriptive system, taking into account new archival theoretical insights. Archivists become aware that computers provide new possibilities. Automation is more than converting existing finding aids in a digitised form; that would be putting old wine into new barrels. Information technology challenges archivists to think about what to describe, and how; it challenges them to analyse data structures, and system functionality. Information Technology enables redesign of descriptive activities, and description systems. The new world of networks, such as the Internet, calls for standards.

A logical architecture of archival description data should be implemented into a technical architecture, including hardware, networks, databases, and application software.

It is far beyond the scope of this report to go into details, but in this technical area as well, standardisation is required to expand the systems life cycle, and to enable exchange of information. It is the world of open systems, communication between computers from different vendors.

5. Conclusion

Let us put the things together, and try to define some basic requirements for image systems from the perspective of archival description.

The first observation was that the index, which provides access to the images, is part of a finding aids system, and consequently should meet the standards and functional requirements of the system whereof it is a part.

The second observation was that finding aids systems are being transmormed into automated systems, and that the scope of such systems tends to get wider than the boundaries of the archives. Technical standardisation is a requirement for successful exchange of information.

In conclusion: the structure of the index should meet the requirements of the finding aids system. Individual keywords must be linked to existing descriptions on the higher levels, such as file, series, and fonds.

The software must at least be able to interface with existing software. For me, an absolute requirement would be that the index data could be stored in the database management system that already is in place. Ideally the system supports any standardised (ISO, ANSI) database management system. Furthermore, the software for input, might be proprietary, specifically developed by the vendor. The retrieval software, however, should be fully integrated with existing retrieval software in use for other retrieval of other records. In my opinion it is highly user unfriendly to change application, dependent of the kind of documents. That might be the characteristic of the existing practice, based on hardcopy finding aids. An electronic finding aids system, however, should be completely integrated, at least from the user perspective.

Every proprietary piece software in this system, decreases the quality, because of user unfriendliness, and higher costs of maintenance.

The keyword is standardisation. Standardisation in all three areas. The area of the image technology, in the area of archival description, and in the area of automation.

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Rijksarchiefdienst, Den Haag

[1] ISAAR (CPF), ICA, *International Standards for Archival Authority Control (Corporate Bodies, Persons and Families)*, Ottawa 1996.

DIGITAL TECHNOLOGY OBSOLESCENCE AND ARCHIVES: PROSPECTS AND POSSIBITIES FOR LONG-TERM ACCESS*

Il rapporto richiama l'attenzione sui rischi dell'obsolescenza tecnologica e le possibili strategie di migrazione dalle tecnologie più tradizionali a quelle più evolute. Nella prima parte sono esaminati alcuni progetti e ricerche che affrontano in via prioritaria il tema delle strategie di migrazione per i documenti elettronici.

La seconda parte identifica e definisce sette requisiti fondamentali per una strategia di migrazione che mantenga nel tempo l'affidabilità e l'autenticità dei documenti.

Nella terza parte del rapporto sono presentati alcuni primi risultati dell'incontro di esperti che si è tenuto a Fermo nell'ambito delle iniziative per il semestre italiano dell'Unione Europea: la garanzia dei requisiti archivistici negli ambienti tecnologici a più alto rischio di obsolescenza e la salvaguardia dell'autenticità dei documenti nei piani di trasferimento a piattaforme tecnologiche più avanzate.

Introduction

This paper is divided into three sections, the first of which reviews briefly three projects now underway that have as their primary focus an articulation of migration strategies for electronic records. This section also discusses briefly several implications of two other research projects – the University of Pittsburgh functional requirements research project and the University of British Columbia research project that focuses upon ensuring the reliability and authenticity of electronic records.

The second section defines seven archival requirements for a longterm strategy that supports access to reliable and authentic electronic strategy. These seven requirements are for readable electronic records, identifiable electronic records, encapsulated electronic records, retrievable electronic records, reconstructable electronic records, understandable electronic records, and authentic electronic records.

The third section of the paper reviews two broad long-term access strategies for electronic records that flow out of the issues paper for the Fermo Experts Meeting and the actual findings and recommendations of the experts who participated in the meeting. The primary emphasis of the first strategy is to maintain the processibility and authenticity of electronic records over time through ensuring compliance with archival requirements for reliable and authentic records, adherence to open systems standards, maintenance of a controlled storage environment, and periodic transfer of

* This is a substantially revised version of the paper originally given at the meeting that takes into account comments and suggestions from several readers. The concept of "encapsulating records" is derived from Ulf Andersson's study discussed in part one.

records to new media. The emphasis of the second strategy, which builds upon the first strategy, is to ensure the authenticity of electronic records when it is necessary to migrate records and software functionalities from an older technology platform to a newer one. In some instances it may be necessary to choose between a loss of processibility of the records because critical software functionalities can not be migrated or acceptance of electronic records that cannot be rendered or viewed exactly as their creators and recipients saw them.

Migration strategy reports and research projects

The January 1995 issue of «Scientific American» contained an article written by computer scientist Jeff Rothenberg that was entitled *Ensuring the Longevity of Digital Documents*[1]. One of Rothenberg's objectives in writing the article was to heighten public awareness of how digital technology obsolescence can make long-term access very difficult, if not problematic. Another objective was to encourage the systematic analysis of the problems of digital technology obsolescence that could lead to the development of tools and concepts that help ensure long-term access in the midst of a rapidly changing technology environment.

At the time that Rothenberg's article was published three major projects[2] were underway to systematically address the question of how archives and archivists avoid technological obsolescence and "ensure technological compatibility, flexibility, and migratability?"[3] One widely publicized effort is the work of a task force on Preserving Digital Documents sponsored by the Research Libraries Group and the Commission on Preservation and Access (United States). In January 1995 RLG and the Commission on a preservation and Access established a "Task Force on Archiving of Digital Information" and charged it with the task of examining the problems and issues associated with providing "continued access indefinitely into the future of records stored in digital electronic form". The focus of this task force is on the impact of digital

[1] J. ROTHENBERG, *Ensuring the Longevity of Digital Documents,* in «Scientific American», 1995, pp. 42-47.

[2] A fourth study entitled *To Preserve and Protect Access to Electronic Records*, published by the Nordic Council of Ministers in 1996, came to my attention too late to be included in this revision. I thank Börje Justrell of the Swedish National Archives for bringing this publication to my attention.

[3] *Teaching Archivists About Technology Concepts: A Needs Assessment,* in «American Archivist», 56 (Summer 1993), p. 435.

technology obsolescence on libraries and archives. The Task Force already has completed its study and it was published in May 1996[4].

The second effort has its roots in the work program of the Image Technology Committee of the International Council on Archives, which in the summer of 1994 adopted a proposal to include the study of digital technology obsolescence and archives as a work item. At the 1995 Annual Meeting of the Association of Canadian Archivists I presented a preliminary report on progress to date that I subsequently expanded into an issues paper on digital technology obsolescence was the focus of an experts meeting this past week in Fermo, Italy[5]. The final report of this conference is scheduled to be completed in late 1996 and will be published shortly thereafter. Much of what is presented in this paper is taken directly from the issues paper and recommendations of the experts. Some of the issues are still under debate and review so the views expressed in this paper should not be construed as fully reflecting the results of that meeting.

The third parallel effort underway is the work of Ulf Andersson, an information technology specialist at the ASTRA Corporation, an international pharmaceutical company in Sweden. Andersson's draft report[6], which was the focus of a conference in Stockholm, Sweden in May 1996, looks at the migration of electronic records from a business model perspective. Many archivists are likely to have difficulty fully comprehending the report because it employs data modelling concepts and techniques that are unfamiliar to many archivists. Nonetheless it is a very impressive undertaking that advances our knowledge of technological solutions and techniques that either are available today or should be developed. Furthermore, the study suggests that the business community and archives can forge an alliance to promote the development and implementation of generic tools and standards that support migration of electronic records.

There are two other research projects underway whose general findings and conclusions have to be taken into account in any consideration of the migration of electronic records. The University of Pittsburgh project's identification of "functional requirements for electronic records management addresses the migration of electronic records[7]. A technical report by David

[4] *Preserving Digital Information: Report of the Task Force on Archiving of Digital Information*, Commissioned by the COMMISSION ON PRESERVATION AND ACCESS AND THE RESEARCH LIBRARIES GROUP, Inc, 1996.

[5] The meeting was supported by the Italian State Archives Administration and the University of Macerata. The experts included Maria Guercio, P.C. Hariharan, Margaret Hedstrom, Maria Pia Mariani, Greg O' Shea, Seamus Ross, Deborah Skaggs, John Van Bogart, Barbara Van Halle, Robert Williams, and the author.

[6] *SESAM, Philosophy and Rules Councerning Electronic Archives and Authenticity* in «Astra», Stockolm 1996.

[7] Ongoing reports and papers can be obtained at www2.lis.pitt.edu\~sochats\nhprc.html.

Bearman and Ken Sochats on the metadata requirements to support periodic migration of electronic records is very constructive and helpful[8].

A research project at the University of British Columbia entitled "The Preservation of the Integrity of Electronic Records" is equally important. Building upon fundamental concepts of archival science, it employs a data modelling technique and a process modelling technique to identify functions and activities that support the preservation of the integrity of electronic records and delineates business rules that specify the conditions that trigger a specific action[9].

Archival requirements for migration strategies

Information technology specialists tend to view the migration of digital material from several different viewpoints, one of which is that migration consists of moving "data from one computer platform or software program to another ....[10]". The *IBM Dictionary of Computing* defines migration as "the process of moving data from one computer system to another without converting the data"[11] and in another place defines data migration as "The moving of data from an on-line to an off-line or low-priority device,...[12]". Implicit in this use is the notion of future retrievalability[13]. From the perspective of archival science, especially with regard to the authenticity of electronic records, defining migration as a set of activities that ensure future retrievability of electronic records is inadequate. Consequently, in this report, migration is defined as the transfer of electronic records from one generation of technology to another in such a way as to permit subsequent users to have the same view of records as their creators or recipients had that ensured the records were complete and authentic[14].

[8] D. BEARMAN-K. SOCHATS, *Metadata Requirements for Evidence* is available at www.lis.pitt.edu~nhprc.papers\model.html.

[9] For a summary of the status of the UBC project see L. DURANTI-H. MCNEIL, *The Protection of the Integrity of Electronic Records: An Overview of the UBC-MAS Research Project*, (Forthcoming in «Archivaria»).

[10] J. KRAYNIK, *The Complete Idiot's Guide to Computer Terms*, Indianapolis, Alpha Books, 1994², p. 189.

[11] G. MCDANIEL, ed. and comp., New York, McGraw-Hill, 1993, p. 433.

[12] *Ibid.*, p. 173.

[13] See P. KING, *Recipes for Successful Archiving*, in «Uniforum Monthly», 1995, pp. 34-38.

[14] This definition goes beyond the definition of migration used in the draft report, *Preserving Digital Information*, which specifies it as "a set of organized tasks designed to achieve the periodic transfer of digital materials from one hardware/software configuration to another, or from one generation of technology to a subsequent generation. The purpose of migration is to retain the ability to display, retrieve, and use digital information in the face of constantly changing technology".

A narrow interpretation of "me view of records" would require that this could only apply to original electronic records as defined by archival science. However. this ignores the fact that an original record is the one an addressee receives[15] while an imitative copy is what the sender sets aside for preservation. An imitative copy of a record – such as a photocopy – faithfully reproduces all of the detail of a record that was required to make it complete and effective. The fact that a photocopy of a document may not capture extrinsic information such as color of the paper and ink or other physical characters of the paper (e.g. acid free) does not alter its status of being an imitative copy, which for archival science (and legal admissibility) does not detract from its authenticity[16]. Hence, for the purposes of this study the phrase "same view of records" means that electronic records can be rendered in such a way that the attributes of them that gave rise to confidence in their reliability and authenticity at the time of creation and receipt are present and accessible to subsequent users of the records.

Terry Eastwood and Luciana Duranti, who are my colleagues at the University of British Columbia, are engaged in a research project on "The Preservation of the Integrity of Electronic Records" sponsored by the Social Sciences and Humanities Research Council of Council that addresses these questions. Drawing upon diplomatics concepts and employing the deductive method of research, they have identified the attributes of reliable and authentic records, which they have described in an article in a recent issue of Archivi Computer[17].

In this article, Duranti and Eastwood argue that the same conditions and requirements that diplomatics stipulates for traditional records also are necessary for electronic records. These conditions and requirements include physical structure, logical or intellectual structure, context, and content. With

[15] As Luciana Duranti notes, the process of electronic transmission of a record frequently adds information (routing, time, distribution lists) that is not part of the originator's copy of the record. See *Diplomatics: New Uses for an Old Science,* Part. VI, «Archivaria» 33 (1991-92), p. 10.

[16] Other similar features include monochrome versus color display and dot matrix versus laser printing. This point is particularly relevant with regard to fax messages that are created on a PC and then transmitted electronically via a fax board. Incoming fax messages to a standard fax machine will be printed at 180 dots per inch on fax paper. However, the print density of incoming messages to a fax board installed in a PC is a function of the printer available and could be printed at densities ranging from 200 dpi to 600 dpi. For a useful discussion of fax messages as records see E. WODARCZAK, *The Facts About Fax: Facsimile Transmission and Archives* (Master of Archival Studies Thesis: University of British Columbia, Vancouver, BC, 1991) 47-76.

[17] L. DURANTI-T. EASTWOOD, *Protecting Electronic Evidence: A Progress Report on a Research Study and Its Methodology* in «Archivi & Computer», 1995, pp. 213-250.

these considerations in mind, Duranti and Eastwood examine the requirements for the creation or receipt of a traditional, nondigital record. From these requirements they extrapolate seven attributes of electronic records.

- medium
- content
- form
- persons
- acts
- archival bond
- transmission[18]

A reliable record is one that is trustworthy as evidence and "can stand for the facts they are about"[19]. According to Duranti and Eastwood, a reliable electronic record is one that is diplomatically complete (i.e. it contains date [chronological and topical], originating address, name of author/writer, addressees, receivers [name of copied persons], title or subject, and action). From diplomatic completeness they extract the following requirements:

- date of receipt/transmission
- time of receipt/transmission
- author
- addressee
- classification code
- registry number[20].

An authentic record is one that is one that is what it purports to be, that is it has not been altered or otherwise changed after its creation. This is achieved by linking the elements of diplomatic completeness with the assurance that no alteration has occurred. Duranti and Eastwood suggest that the latter can be accomplished with the use of date stamping or a cryptographed seal[21]. As will be noted later, there are other techniques that can help ensure that electronic records have not been altered over time.

Within this context of archival migration there are seven archival requirements that a digital technology migration strategy for electronic records must satisfy. These requirements are: readable records, identifiable records, encapsulated electronic records, retrievable records, reconstructable records, understandable records, and authentic records.

[18] *Ibidem.*

[19] L. DURANTI, *Reliability and Authenticity: The Concepts and Their Implications,* in «Archivaria», 1995, 6. Duranti adds that "Reliability is provided to a record by its form and procedure of creation" and notes that this involves these dimensions: the completeness of the record, the reliability of the procedure, and/or the reliability of the author".

[20] L. DURANTI-T. EASTWOOD, *Protecting Electronic...* cit., p. 228.

[21] *Ibid.,* p. 231.

Readable. Readable electronic records means that the bit stream comprising electronic records can be processed on the computer system or device that initially created it, the computer system or device that currently stores it, or the computer system or device used to store the digital information in the future. Non-readability of electronic records may occur in two different ways, the first of which may result from a hostile storage environment. All of the storage media for digital records used in the past and present share a common wlnerability to poor environmental storage conditions. Magnetic storage media are vulnerable to fluctuations in temperature and humidity extremes as well as to stray magnetic fields and require a controlled storage environment in order to ensure a maximum longevity[22].

Optical digital media also are vulnerable to a hostile environment.

The second aspect of non-readability occurs when some feature of the storage device (a tape or disk) is physically incompatible with the available device and therefore cannot be read by a computer. This particular manifestation of digital technology obsolescence is called hardware obsolescence as storage devices and media used in the past become incompatible with those used in the present or that are likely to be developed in the future[23].

Identifiable. Identifiable electronic records are organized and described in such a way that it is possible for users or a system to distinguish between information objects based upon a unique attribute such as record name or record ID number and form of material. A record ID serves as a pointer to a specific record that is the by-product of a specific transaction and at the same time stands as the physical and logical boundary between records. Without such boundaries the only way to confirm that a desired record is in a body of electronic material is through visual browsing of strings of alphanumeric characters.

Encapsulated[24]. From an archival perspective encapsulated records

[22] Recent studies of magnetic media by the National Media Lab indicate that the life expectancy of flexible magnetic media can be extended to twenty years at a temperature of 50 Fahrenheit and 25% relative humidity. This runs counter to the accepted notion that archivists have held for almost two decades that a "hostile storage environment" is one in which the temperature and relative humidity do not respectively exceed 68° Fahrenheit and 50 percent for an extended period of time.

[23] A good example of this is the unsummarized census data on computer tapes used in tabulating the 1960s Decennial Census. For more details see, p. 000 is based upon a study of the 1960 Census tapes prepared by T. E. Brown and M. Adams of the Center for Electronic Records of the National Archives and Records Administration of the Unites States. In March of 1996 they kindly shared an electronic draft of the study with the author.

[24] Many computer specialists, especially those who work with object oriented database, view encapsulated objects as containing both data and the methods used to process the data. In other words, the data and the application are not separate entities. Consequently, the data in an encapsulated object can only be used with the methods specific to the object. See J. MARTIN, *Principles of Object-Orients Analysis and Design*, Prentice Hall, Englewood Cliffs, NJ, 1993.

should be self-referential because all of the information, such as metadata, content, and linkages to multimedia, associated with a specific record would exist as a single entity. This is an important concept because such techniques as object link embedding (e.g., Microsoft Word) or hypertext in essence create dynamic records that consist of pointers or linkages to files that may exist on multiple media and servers and can only be used with specific software[25]. Logical encapsulation (e.g., MS WORD object link embedding) can be maintained and preserved in a single technology generation but it becomes increasingly difficult to achieve this across multiple technology generations and adds several levels of complexity. Ideally, when electronic records, particularly those in a multimedia format, become inactive and are transferred from an operational environment to transferred to a competent archival entity[26], this merging or pasting would occur. And, of course, this should be documented. Delaying this merger would increase the risk in the future of not being able to reconstruct all of the components of electronic records.

Retrievable. The fourth archival requirement for access to electronic records is retrievability, which means that discrete information objects or parts of them can be retrieved and displayed. Retrievability requires keys or pointers that link the logical structure (e.g., data fields or text strings) of information objects to their physical storage locations and permits discrimination between and among information objects. Generally, this linkage information may be found in a file header or label that includes the information required to locate the beginning of an object, to indicate the number of bytes of each component or data element and its physical location (e.g., sector and track number for hard disks and floppy diskettes). The interpretation of the logical structure of records is a function of an operating system (MS-DOS) or a device driver in conjunction with the search and retrieval software of a particular application system. The retrievability of information objects is, therefore, inextricably linked to a software application and operating system. Unless there are built-in migration paths or newer generations of the software that offer backward compatibility to older versions of the software, retrieval of electronic records

[25] This seems to be the approach taken by Ulf Andersson with the use of cross hashing signatures. He has proposed protecting the linkage between metadata and record content through the use of electronic signatures that he defines as crosshashing. Presumably this means linkages between a specific record, and, say, a relational database that contains a distribution list associated with it.

[26] This term is used in the University of British Columbia Study on "Protecting Electronic Evidence" to mean an independent entity (i.e., one not accountable to the record creators) whose mandate is to store and maintain inactive electronic records in such a way as to ensure that the attributes made them original electronic records are not altered.

will be impossible even though the media may be readable, the records are identifiable, and encapsulated.

Reconstructable. The fifth requirement is what has been tentatively identified as reconstructable electronic records[27]. Reconstructable records means that they can be displayed or printed so that they have the same logical and physical structure and intellectual content as they appeared at time of their creation or receipt. This "same logical and physical structure and intellectual content" of electronic records means those internal and ex- ternal features of records that were required for them to be complete and effective. In this sense, fully reconstructed displays or renderings constitute "imitative copies" that include these features, which also help preserve their authenticity.

Of course, electronic records can be reconstructed in terms of ASCII text but archival science would treat them as "simple copies" that are nothing more than transcriptions and therefore lack authenticity. For all practical purposes, a simple copy becomes a new record whose reliability must be established. The question of what constitutes an adequate archival copy of electronic records should be a major consideration when formulating a digital migration strategy.

Understandable. The sixth requirement is understandability of records. It presumes recognizing letters that form words, which, in turn form sentences but there is the larger issue of what the record itself means. The meaning of a record is not determined solely by the words in it that convey intellectual content but also by its context of creation and use. This context of creation and use involves relations between and among other records that Luciana Duranti and Terry Eastwood have defined as the archival bond[28]. This archival bond can be captured in a variety of ways, including a reference code to other records dealing with the same issue or a classification code that links records relating to the same transaction and related transactions.

Ensuring the understandability of electronic records as they are migrated to newer technologies differs sharply from that of ensuring the understandability of paper records. Unlike paper records that typically convey the context of creation and use in the physical characteristics of the records, the context of creation and use of electronic records is logically linked, not physically. Some of these logical linkages are captured in metadata but as David Bearman and Ken Sochats note the scope of the

[27] The experts at the Fermo meeting reviewed this term and tentatively accepted it, subject to further discussion and review.

[28] *Protecting Electronic*... cit., p. 223.

metadata required to ensure understandability must be expanded considerably[29].

Authentic. The seventh requirement is authentic records. Authentic records are what they purport to be, that is they are reliable records that have not been altered or changed or other wise corrupted. The reliability of electronic records is a product of the record making/keeping environment. Luciana Duranti, has addressed the problem of the reliability of electronic records. She notes tha "Reliability is provided to a record by its form and procedure of creation", which is encompassed by the completeness of the record, the reliability of the procedure, and the reliability of the author[30]. In contrast, the authenticity of electronic records – they are what they purport to be because no alteration or change has occurred – is reliability over time and is provided to records because thay are protected from alteration and change by a "competent archival entity". Interestingly, a digital technology called "hashing" makes it possible ot detect if there has been any alteration in the bit stream underlying one or more electronic records.

Alternative migration strategies for electronic records

The issues paper for the experts meeting mentioned earlier discussed a general migration strategy for electronic records that can be subsumed under the general heading of "high technology dependence." The primary objective of the high technology dependence strategy is to retain the processibility of electronic records that gave rise to them in the first place[31].

One way of implementing the high technology dependence migration strategy is through in "incremental" approach that essentially calls for a continuous updating of system functionality through selective hardware and software upgrades as the technology evolves, combined with a scheduled

[29] They propose a "Reference Model for Business Acceptable Communications". See *Metadata Requirement for Evidence*, in *Managing Electronic Records,* Cohasetts Associates, Chicago 1995. The reference model incorporates six layers or clusters that include the Handle Layer, the Terms and Conditions Layer, the Structural Layer, the Contextual Layer, the Content Layer, and the Use History Layer.

[30] L. DURANTI, *Reliability and Authenticity* ... cit., p. 6.

[31] There is a very interesting book entitled *Migrating Legacy Systems: Gateways, Interfaces & the Incremental Approach* written by M.L. Brodie and M. Stonebreaker that archivists involved with electronic records or the use of digital information technologies should read. Brodie and Stonebreaker focus on the key issues in migrating software functionality and legacy data, the latter of which can be construed as historical or archival electronic records, into new technology environments. They discuss two migration strategies – incremental and revolution- ary – that retain the processibility of electronic records.

systematic media copying program[32]. This would result in a hybrid environment in which there would be digital technology components in three different stages: what is on the verge of becoming obsolescent; what is in current use; and what is on the cutting edge of new technologies. The advantage of this approach is the opportunity to work with established vendor-manufacturers as their product lines evolve and to take advantage of the latest technological advances. Furthermore, in a rapidly evolving information technology environment, this approach provides considerable technological stability. However it could prove to be very costly because of the necessity of continuous system upgrades with no foreseeable end to them.

The second way of implementing the high technology dependence migration strategy is what can be characterized as "nonincremental". It involves transferring digital material that is on the verge of becoming obsolescent to a newly emerging one. In effect, it "leap frogs" from a technology generation on the verge of losing its usefulness to state-of-the-art one, bypassing the current technology generation[33]. This strategy requires "backward technology compatibility," which is the capacity of a new technology to function similarly to the one it replaces, in addition to its new and different capabilities.

A digital migration strategy process model, shown in Figure 1, lays out schematically the incremental and non-incremental migration strategies.

The function of a process model is to increase the understanding of a complex phenomenon by eliminating any detail that does not affect its relevant behavior, such as who does what and how it is done[34]. For conceptual clarity the schema is limited to four technology generations that occur at unspecified intervals although there is no logical and technical impediment to extending it across many more technology generations.

The solid black horizontal line in the upper third of each technology generation box represents the incremental migration strategy. At the top left of each technology generation box there are four vertical arrows that represent external requirements that must be satisfied. The first arrow denotes archival requirements, which encompasses the seven requirements described earlier, that each technology generation must support. The standards constraint mandates the use of open systems architecture, non-proprietary standards, and

[32] In many respects this model coulb be viewed as falling under the Hierarchical Management Storage rubric.

[33] Jack Olson calls this the "big-bang" solution that can be characterized as "an all-or-nothing migration". *Building a Database Topology Strategy,* in «Database Programming and Design», 8, 4 (June 1995), p. 60.

[34] B. CURTIS-M.I. KELINER-J. OVER, *Process Modeling,* in «Communications of the ACM», 33, 9, 1992, pp. 75-76.

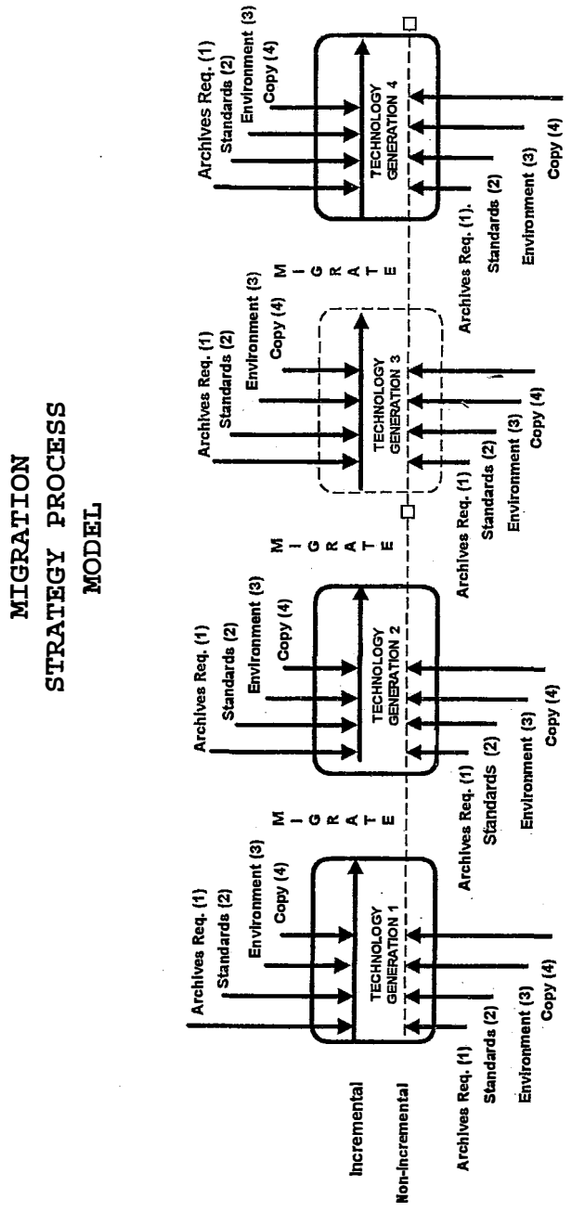

Fig. 1

national and international standards. The third constraint is called environment and refers to the maintenance of relative humidity of 25 percent and temperature at 50 degrees Fahrenheit and a monitoring program to periodically read media to ensure that no catastrophic loss has occurred or may be impending.

The copy constraint means that electronic records will be transferred periodically to new media in order to ensure their continued readability. A key component of the copy constraint is an explanation of the procedure and processes used in order to document that the records have not been altered in any way. The actual time frame in which periodic transfer occurs will depend upon predicted media life expectancy and the introduction of new media and storage devices. Everything that is done to electronic records in each technology generation should be fully documented. Metadata must be created and preserved that documents how and when copying and migration occurred and that the underlying bit stream of the records still can be represented as their creators and users viewed them. If there is any degradation in the bit streams that results in the modification of this representation, this must be documented in the metadata[35].

The black dashes line in the lower third of each technology generation denote the non-incremental approach to migration. The small square between Technology Generation 2 and 3 and after Technology Generation 4 denotes when this migration may occur. As noted earlier, this approach involves staying with an existing technology generation to the very last moment and then by-passing the current technology generation to one that is emerging. At the lower left side of each technology generation box there are four vertical arrows that represent the same four external constraints affecting the incremental strategy. The only difference between the non-incremental and incremental migration strategies is that the latter involves a massive infusion of new technology just as the old technology is on the verge of becoming obsolescent. It might also be noted that this approach involves a substantial risk that full backward compatibility across two technology generations may not be available.

A digital migration strategy – incremental or nonincremental – must take into account variations in the format of electronic records and how these variations influence the actions that are carried out within each technology generation. Currently, there are six different formats[36] – text, image, vector graphics, structured data, audio, and moving images. A migration activities

[35] For an excellent review of metadata requirements that support the migration of electronic records see the previously cited work of David Bearman and Ken Sochats.

[36] It will be recalled that metadata is an archives requirements. However, metadata in quite likely to be captured in one of the six formats, such as text.

model, which is displayed in Figure 2, identifies seven different formats of electronic records: text, image, vector, structured data (spreadsheets and databases, metadata, audio recording (voice mail), and moving images[37].

So far as archival requirements and environment actions are concerned, the difference in storage format makes no substantive difference. Storage format in general, however, is crucial in the standards actions. Activities associated with specific formats and their relevant standards are identified in the decomposition of the standards activities that is shown in the Figure 3, "Standards To Support Digital Migration." This diagram notes that digital images can be compressed in order to reduce storage requirements but that for archives preservation only lossless compression should be used[38].

The foundation on which the two digital migration strategies rest is adherence to non-proprietary digital information technology standards. Because these standards minimize, and in some instances perhaps eliminate, data exchange and computer incompatibilities, they can support interoperability and upward migration paths across technology generations, which are crucial to ensuring access over time. Non-proprietary digital technology standards are neither a panacea nor a "one-time" fix.

Standards reflect current technology and inevitability new standards will emerge to replace old ones and careful attention must be procurement of new equipment and software to ensure that the appropriate standards are supported.

In some instances it may not be possible to migrate some electronic records from one technology generation to another because of the degradation of authenticity, the cost involved,[39] or the loss of software functionality without which it is not possible to have the same view of records as their originators and recipients had. In these circumstances there are few options. One option would be to migrate records with degraded authenticity[40] but to fully document

[37] Note that metadata is not included as a format as such.

[38] Compression is fairly straightforward for digital images but becomes rather complex with regard to moving images where the standard in use is called MPEG. Tom Cavanagh of Canadian Broadcasting Corporation has noted that lossless compression of moving images is so limited (a factor or two) that compression for program production and delivery that has a reduction factor of three to five "are now considered by man to be quite acceptable compression for program acquisition and presentation purposes". See *Electronic Recording, Media and Digital Technology for the Archive*, Annex E, *The Conservation of Canada's Film and Magnetic Media Heritage. Summary Report May 1995* in «Fading Away. The Preservation and Enhanced Use of Canada's Audiovisual Heritage» National Archives of Canada, Ottawa, 1995.

[39] There are instances of successful, migration from one technology platform to another when a migration functionality was not included in the original system design, but both the cost and the amount of time required to complete the migration were greater than anticipated. See G.S. AHUJE-T. HART-J.SINGH, *Role of Relational Database Management System an Client/Server Technology* in *EMS Migration* in *IEEE,* 1993, pp. 233-239.

[40] According to the precepts of diplomatics, the migrated records would be new records. See L. DURANTI, *Diplomatics: New Uses* ... cit., p. 10.

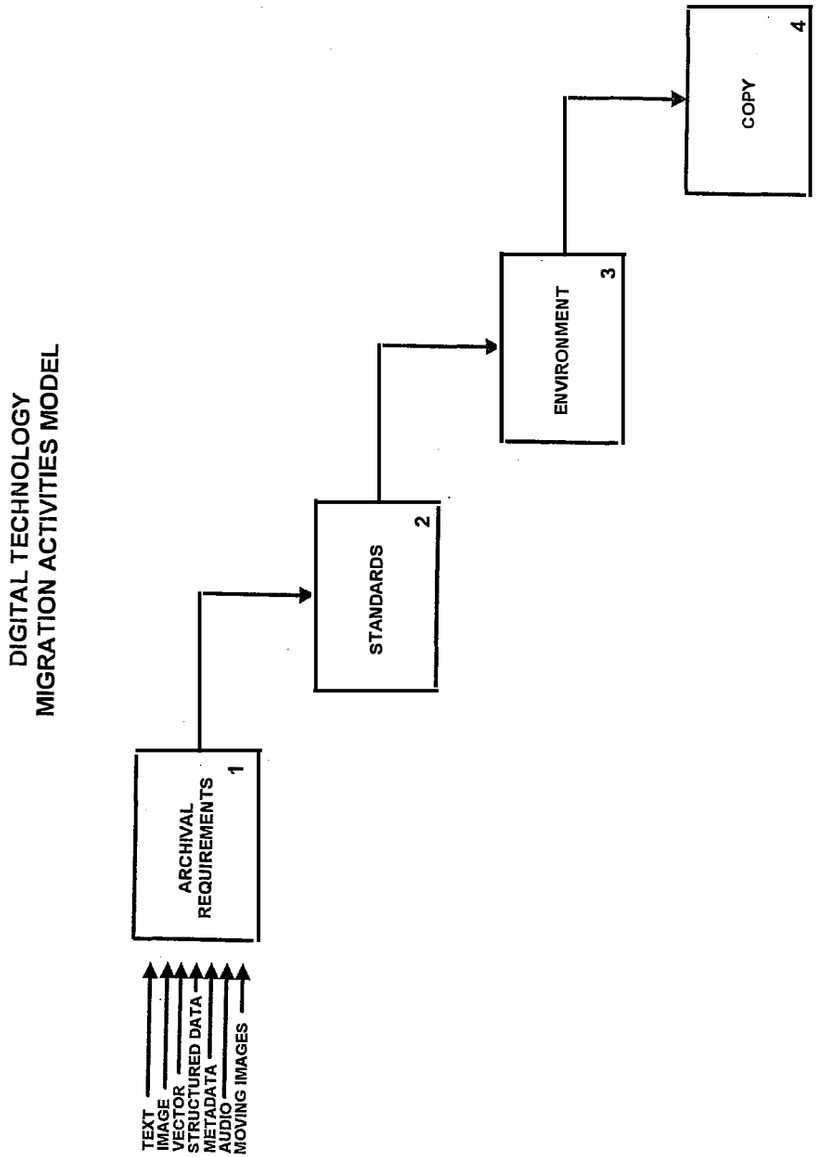
DIGITAL TECHNOLOGY
MIGRATION ACTIVITIES MODEL
ARCHIVAL REQUIREMENTS 1
STANDARDS 2
ENVIRONMENT 3
COPY 4
TEXT
IMAGE
VECTOR
STRUCTURED DATA
METADATA
AUDIO
MOVING IMAGES

Fig. 2

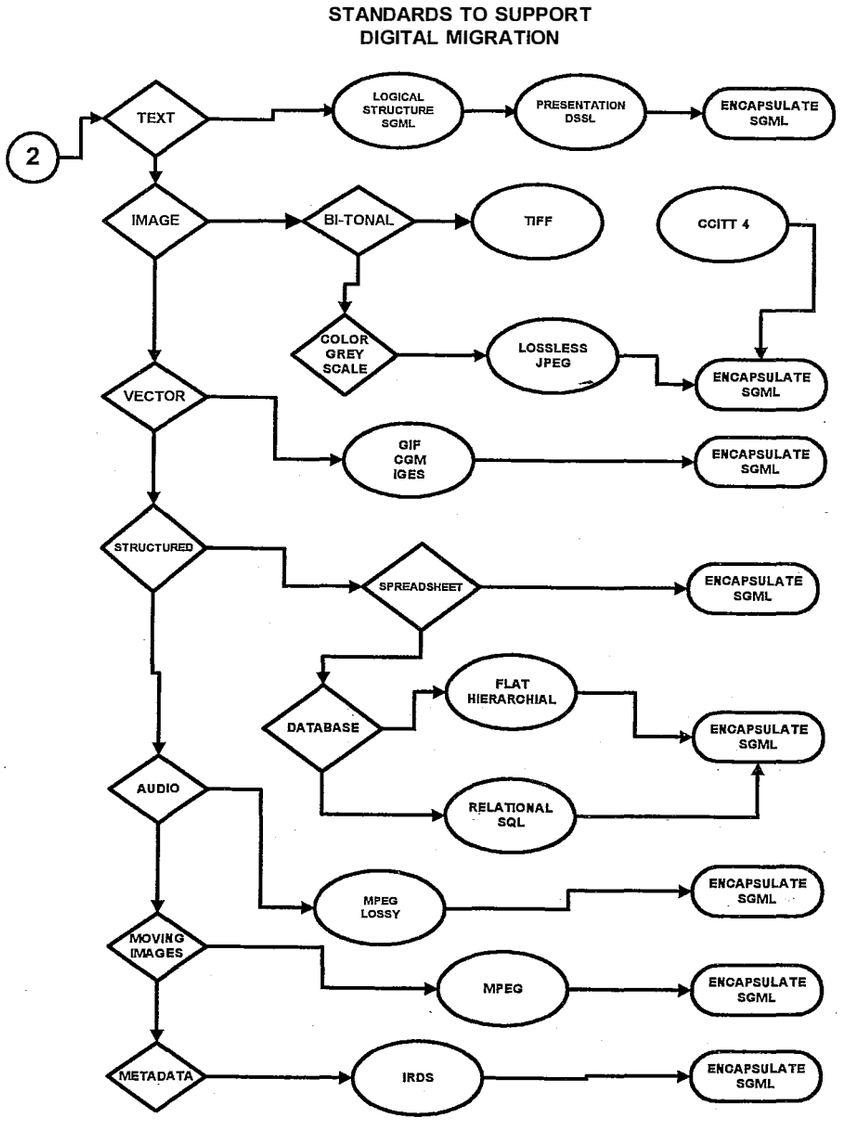
STANDARDS TO SUPPORT
DIGITAL MIGRATION
2
TEXT
LOGICAL STRUCTURE SGML
PRESENTATION DSSL
ENCAPSULATE SGML
IMAGE
BI-TONAL
TIFF
CCITT 4
COLOR GREY SCALE
LOSSLESS JPEG
ENCAPSULATE SGML
VECTOR
GIF CGM IGES
ENCAPSULATE SGML
STRUCTURED
SPREADSHEET
ENCAPSULATE SGML
DATABASE
FLAT HIERARCHIAL
ENCAPSULATE SGML
RELATIONAL SQL
AUDIO
MPEG LOSSY
ENCAPSULATE SGML
MOVING IMAGES
MPEG
ENCAPSULATE SGML
METADATA
IRDS
ENCAPSULATE SGML

Fig. 3

this in metadata accompanying the records. A second option would be to do nothing and simply let the records succumb to technological obsolescence. A third option would be to migrate the records to an analog storage technology such as microfilm that would ensure the preservation of both the authenticity of the records and the view of the records that their originators and users had. The vertical arrow pointing downward in Figure 1 denotes this option.

Low Technology Dependence

A low technology dependence strategy is non-linear in that it involves a fundamental break between current and future digital technologies. In effect, the strategy allows electronic records along with software to remain dormant until the need arises to access the records. Jeff Rothenberg has argued that ensuring access two hundred years from now to digital material being created and saved today requires "encapsulating" it in such a way that it

> "allows the computation environment on which it depends to change transparently, without affecting the accessibility and readability of the stored information."[41].

Given the fact that this is an unrealizable goal because no implementation tools exist, is there another alternative, at least in the short-run?

Implementation of the low technology dependency strategy ensures significant access with a minimal reliance on technology that rapidly obsolesces is realizable. Microfilm[42] offers an acceptable low technology dependence solution that ensures significant access without computer mediation, particularly with regard to page analog digital information. Despite the appeal of low technology dependence, microfilm has a substantial downside that includes cumbersome manual search and retrieval processes that are time consuming, location specific (i.e., in one geographic place), and sequential user access. Equally as important is the necessity of storing microfilm in a controlled environment in order to ensure there is no media degradation. Furthermore, this low dependence migration strategy cannot capture the complex relationships of Geographic Information Systems, relational databases, and audio recording (e.g. voice mail), among others.

[41] J. ROTHENBERG, *Ensuring the Longevity* ... cit., p. 46.

[42] Silver halide microfilm is extremely durable with a projected life expectancies measured in hundreds of years if stored in a proper environment. See *Preservation of Historical Records*, National Academy of Science, 1986.

Nonetheless, for page analog digital information, microfilm offers a very attractive alternative to digital text documents. Optical character recognition technology will permit cost-effective retrospective conversion back to digital form as circumstances may dictate in the future[43].

Another important aspect of this low technology approach is the question of how to ensure that the functionality of today's software is operational in the future. Creating a museum of operational hardware and software is not the answer. Instead, a more plausible approach is software emulation, which is generally used to run "older" computer programs in a new computational environment. This same concept of "emulation," or logical replication, could be utilized in a form of reverse engineering, say, fifty years or one hundred years from now, that would emulate the software and hardware environment of the original application environment.

The Multimedia Migration Strategy Process Model (Fig. 4) delineates how microfilm could be utilized as a migration of last resort in conjunction with the use of OCR and hardware/software emulation. The solid black emanating from a black dot just before "Migrate" between Technology Generations 1, 2, and 3 indicates that a migration to microfilm can occur. The black dash line leading from microfilm up into Technology Generations 2, 3, and 4 denotes that the microfilm records have been converted back into a digital processible form and that a software emulator can provide the required software functionality. Both the OCR conversion and the software emulator would be implemented on a demand basis.

It is quite likely that OCR technology will be available far into the future but it is less clear that hardware/software emulation will be available. The availability of reverse engineering software tools to replicate software and hardware functionality will depend upon a number of factors, includlng market demand. It may turn out that there is insufficient market demand for generalized reverse engineering tools for emulation purposes so that it will be necessary to develop specific emulation software.

Emulation software is more than an idea. Doron Swade, Senior Curator (Computing and Data Processing), Science Museum inLondon, reported the successful emulation on a DOS 386 PC of the first commercial computer developed in the United Kingdom[44]. Called the Pegasus, it was in use between

[43] See *La gestion des Archives informatiques*, University of Quebec Press, Quebec 1994, for a discussion of the results of an extensive study conducted between 1991 and 1994 regarding the feasibility of storing computer processible information on microfilm and then converting it back to computer processible form.

[44] D. SWADE, *Collecting Software: Preserving Information in an Object-Centered Culture*, in *Electronic Information Resources and Historians: European Perspectives*, S. ROSS-E. HIGGS, The British Library Board, London 1993, pp. 93-103. A copy of the DOS-based emulation program may be obtained from the Computer Conservation Society.

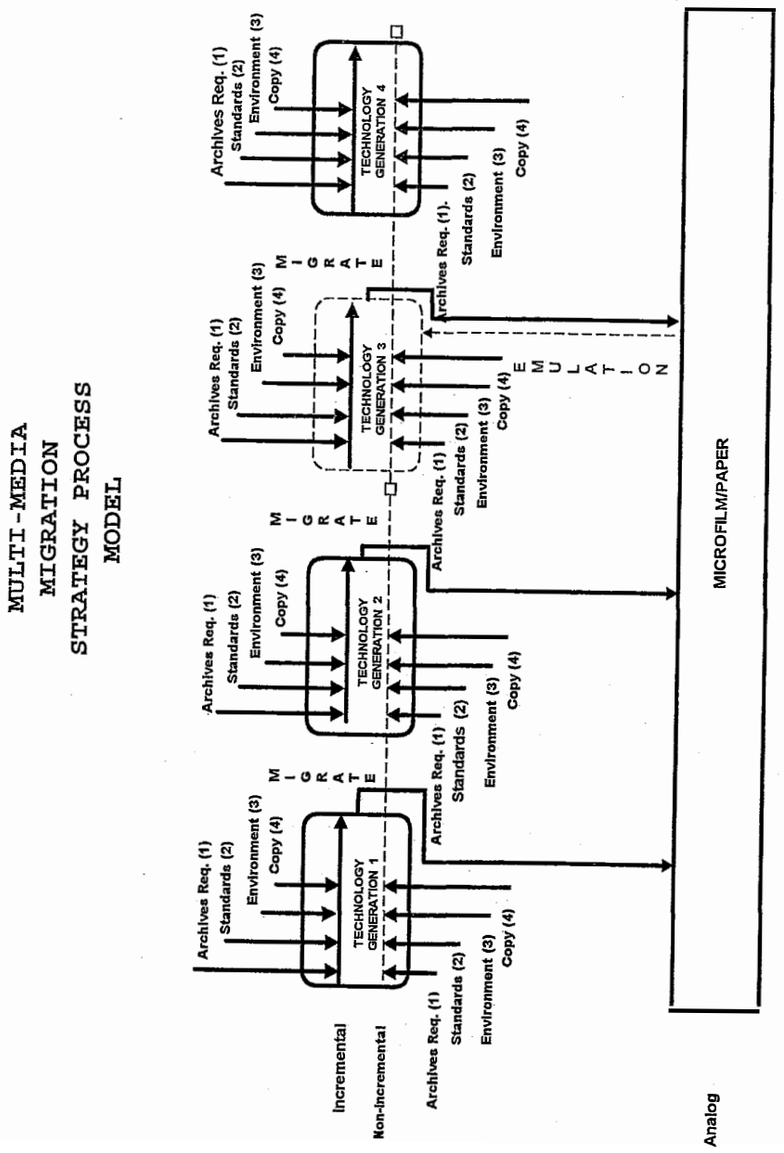

Fig. 4

1959 and 1962 and utilized paper tape and magnetic drums for storage of data[45].

The second example is a "reverse engineering" of the world's first general purpose electronic computer known as the Electronic Numerical Integrator and Computer (ENIAC) that became operational in February 1946. ENIAC, which was developed at the Moore School of Electrical Engineering at the University of Pennsylvania with funding from the U.S. Army, utilized vacuum tube and resister technologies, mechanical switches, and heavy wiring cables, all housed in a unit that measured 80 feet by three feet and weighed almost thirty (30) tons[46]. The 18,000 vacuum tubes and 170,000 resistors, and other components of ENIAC were placed on a single silicon chip mounted on a circuit board that can be connected to a PC that supports a graphical user interface with the chip. The graphical user interface displays an instrument panel that replicates the form and appearance of the ENIAC console, including programming switches, control switches and the like. These switches can be used to establish program settings and create a data file that is sent to the ENIAC chip for processing. The results are then displayed on the PC monitor in much the same way they were on the ENIAC itself while it was operational[47].

These two examples of using advanced computer technology to emulate obsolete operating systems and software suggest that even more powerful and "smart" reengineering tools in the future could resolve many of the technological obsolescence issues that today appear to be intractable. Of course, the implementation of software simulation in the future depends upon the availability of technical documentation. What is required is an archives of computer software that could take on the task of systematically collecting extant commercial software either from the vendors that developed it or from users who have retained it. Establishment of one or more computer software archives would satisfy an essential requirement for reverse engineering that would permit digital technologies of the future to emulate yesterdayls and today's technologies and thereby ensure long-term access to digital material.

[45] Seamus Ross has noted that "... the experience of having seen the thirty-five year old machine run and perform the same data processing tasks provided an understanding of the process of work in the late 1950s that no simulation could have done". *Preserving and maintaining electronic resources in the visual arts for the next century?* in «Information Services & Use» 15, 1995, p. 374.

[46] ENIAC, *A special issue of "Penn Printout"*, 1996. I thank Seamus Ross for bringing this to my attention.

[47] For more information about Eniac-on-a-Chip, see http://'www.ee.upenn.edu/jan/eniacproj.html.

Conclusion

I want to conclude this paper by summarizing several recommendations that emerged from the Fermo Experts Meeting that merit serious consideration by archivists and records managers. The first identifies the need for archival institutions to delineate policy requirements that among other things establish a migration strategy policy that is cognizant of the regulatory environments and mission statements of organizations, that minimizes cost while reducing the risk of any loss in reliability, authenticity, and understandability. This policy statement should also call attention to the need for training of archivists and records managers in this area and encourage the use of best practices. Finally, the policy statement should stipulate that the choice of a migration strategy must be fully documented. In other words, whatever migration strategy is implemented, the reasons for its selection must be fully described and justified.

The second recommendation involves guidelines and best practices in the implementation of a migration strategy in terms of the organizational and technical infrastructure that is required. Among other things, a robust, versatile, and open hardware/software platform is essential for access to migration of electronic records. Regular monitoring of the readability of electronic records is an absolute best practice. Identification of the criteria that should be followed in the selection of media as well as the maintenance of appropriate environmental storage conditions and proper initial copying procedures is the focus of the third recommendation. A fourth recommendation addresses the issue of standards particularly with regard to open systems. Particular attention must be given to the importance of non-proprietary standards, the IEEE Reference Model, communication standards, file structure/formats and metadata standards and issues. The fifth recommendation calls for training for archivists and records managers so that they informed and up-to-date on technology trends and how to use technologies for migration purposes. Such training would include workshops for senior executives in order to inculcate the significance of migration strategies and workshops for archivists and records mangers that provides them will tools to use on the job. The sixth and final recommendation calls for the establishment of a Center for Preservation and Access to Electronic Records. It is unlikely that any one archives will have sufficient resources (financial and human) to implement and maintain the best practices for maintaining access to electronic records over time. Hence, an European Center for Research and Training that provides migration services for those organizations with limited resources, provides training, serves as a clearing house for information and practical guidance, and conducts research into electronic records issues is crucial.

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APPENDIX

1960 CENSUS TAPES[48]

In 1960, the Census Bureau relied exclusively on Sperry-Rand UNIVAC computer technology in tabulating and analyzing census data that was in computer-processible form. Collection of census data involved respondents answering questions by marking with a pencil the appropriate responses. Census household returns were microfilmed and then converted into computer processible form by a device called FOSDIC (Film Optical Sense Date Input to Computer) that scanned the microfilm and converted marked responses to questions into binary data. This microdata captured information at the household level and was then aggregated into a variety of census tabulations.

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The Census Bureau did not consider the microlevel data as record material, so the data was not retained after the tabulations were completed. However, aggregations of data at other levels were retained and written on to computer tapes by UIVAC II-A tape drives, which were proprietary products of the UNIVAC Computer Company. The Census Bureau retained these tapes for programmatic purposes, such as a comparative study of the 1960 and 1970 Decennial Censuses.

Between 1963 and 1975, when the National Archives of the United States began inquiring about the status of the 1960 census tapes, the UNIVAC II-A tape drives were superseded by III-A tape drives. Also, the Census Bureau had begun to use "industry compatible" tape drives and media (IBM drives and tapes). By 1975 the Census Bureau had approximately 7,297 II-A tapes, 1,678 III-A tapes, and 146 ""industry compatible tapes". A review of these tapes by a staff member of the Machine-Readable Archives Division disclosed that only 642 of the 7,297 II-A tapes contained information of long-term value. The Census Bureau agreed to reformat the data on these 642 II-A tapes and write it to industry compatible tapes.

[48] This account is based upon a report prepared by Thomas E. Brown and Margaret Adams, (April 3, 1996) and recollections of the author, who was Director of the Machine-Readable Archives Division during the 1970s.

Carrying out this task involved a major reengineering effort because UNIVAC no longer supported II-A tapes or tape drives and the few drives in the Census Bureau were badly in need of repair and replacement parts. A solution was found, however, in the FOSDIC drives mentioned earlier because they contained key components of the obsolete II-A drives. The Census Bureau cannibalized the FOSDIC devices and obtained sufficient parts to keep the II-A drives operational long enough to copy the selected tapes[49]. By 1979 the Census Bureau had reformatted 640 of the II-A tapes and recorded the data onto 178 industry compatible tapes. Permanent "read" errors were encountered on several tapes due to media degradation so that 1,575 of the 1.5 million records were unreadable. The remaining two tapes, which according to a tape inventory contained 7,488 records, could never be located in the Census Bureau tape library. Although no cost data for this massive project are available, it seems clear that periodic copying of II-A tapes to industry compatible tapes would have greatly reduced the cost to the Census Bureau cost of ensuring the readability of the data on the tapes.

[49] In 1985 the Committee on Records of Government Report (Council on Library Resources: Washington, 1985), 9 erroneously asserted "... that when computer tapes for the 1960 census came to the attention of archivists, there remained only two machine capable of reading them. One was already in the Smithsonian. The other was in Japan". This same assertion was repeated in a 1990 report by the United States Senate entitled *Taking A Byte Out of History* as well as in the *Draft Report of the Task Force on Archiving Digital Information.* The source of this assertion was a statement the author made in 1978 at the meeting of the Association of Public Data Users (APDU). The statement was in response to a question about what the National Archives could do to ensure the transfer data on II-A tapes created by other organizations that used II-A tape drives to newer tape formats. The response was facetious, particularly the reference to Japan, and was intended convey the futility of such an endeavor.

GUIDELINES FOR THE PRESERVATION OF MICROFORMS

Le microforme rappresentano un supporto eccezionalmente stabile per la conservazione dell'informazione documentaria. Per assicurare tuttavia nel tempo questa qualità essenziale nella riproduzione d'archivio, è necessario assicurare al programma di fotoriproduzione una progettazione adeguata.

Gli autori identificano ed illustrano nove fasi nello svolgimento del progetto, che ne assicurano la migliore realizzazione; ad esse si aggiungono i requisiti per la conservazione e l'uso delle microforme. Il testo è corredato da informazioni bibliografiche e da una rassegna degli standard internazionali.

Introduction

Microform on a permanent material is a very stable medium for recording documentary information. Of the media in current general use, silver halide (or silver gelatin) microform is second only to good-quality, acid-free paper in its permanence. Nevertheless, microforms remain relatively fragile. They will

- be unreadable if not filmed and processed correctly
- deteriorate if not on a stable permanent base material and not processed and stored properly
- be easily damaged by careless handling

To ensure that microforms remain usable over an extended period of time, it is essential that the appropriate international standards and best practices are followed through all the stages of a microfilm project.

Stages of a microfilm project

1 Preliminary arrangements
2 Preparation of documents to be filmed
3 Choice of type and kind of microform
4 Filming
5 Processing
6 Checking
7 Duplication
8 Storage and Handling
9 Access and use

The long term usability of microforms also depends upon proper intellectual control, with guides and inventories that contain sufficient information to ensure that users can locate the desired materials. Such

intellectual control should be part of an overall operational archival program that provides for the physical and intellectual control of the archives' total holdings.

The acquisition of microform copies of extraneous documents is an irresponsible act if they are not to be subject to proper physical and intellectual control as a component of a properly managed archive.

The establishment of a program for acquiring microform copies of extraneous documents requires proper preparation and planning. The type of microform to be acquired should be the most appropriate for the purpose in the context of the conditions to be provided for its preservation and use.

The preservation and use of microforms require:

- adequate staff to handle and maintain them
- suitable premises for their storage, maintenance and consultation
- appropriate and well-maintained equipment for checking, duplicating, housing and viewing of them

The primary responsibility for ensuring proper conditions for the indefinite preservation and use of archival microforms rests with the archive which seeks to acquire such microforms. However, that responsibility can be fulfilled in some respects only with the full cooperation of the archives in which the original documents are preserved.

1. Preliminary Arrangements

1.1 Agreements and Formal Contracts

Microforms may be provided under a variety of arrangements between institutions that hold the original documents and the one seeking copies: by exchange, by donation or by purchase. Normally, such arrangements will be bilateral, but where more than two countries share a common cultural heritage, a multilateral arrangement may be more appropriate. When the archive which holds the original documents is a national archive, it may be expected to have its own facilities for producing microforms. However, smaller archives may not have such facilities, and a third party may have to be called upon to undertake the filming.

In some circumstances, it may be appropriate for the terms under which the microforms are to be provided to be the subject of a formal agreement between the parties involved; in other circumstances, a less formal understanding, for example by an exchange of letters, may suffice. Where the filming is to be undertaken by a third party, it should be quite clear whether that third party is acting on behalf of the holder of the original documents or on behalf of the recipient of the microforms. In such cases, a formal contract with the third party is advisable.

1.2 Arrangements to Consider

Whatever the nature and formality of the arrangements between the parties, each party should be quite clear about the terms under which the microform will be provided and about the respective responsibilities of the parties. In particular, the following points should be determined:

- the quantity of documents to be microfilmed
- the price to be paid (if purchase is involved)
- the responsibility for identifying the documents to be filmed
- the responsibility for providing an inventory of the microforms
- the type of microform (silver halide, diazo or vesicular)
- the kind of microform (negative or positive; roll film or microfiche)
- the filming and processing standards
- the ownership or custody of the master negative
- the conditions governing use and reproduction

If the archive which is seeking to acquire microforms does not possess, or have access locally to, facilities for duplicating microforms, the agreement should not be for the provision of master negatives or intermediate masters but for positive viewing copies only. Even where such facilities exist but where the appropriate storage environment cannot be guaranteed, again only positive viewing copies should be provided. Conditions for acquiring additional copies of the microfilm should also be outlined with the archive holding the master negative.

The preliminary arrangement should also include agreement on the facilities to be offered by the holding archive to representatives of the archive acquiring microforms, including access to guides and inventories before the representatives travel to the holding archive.

2. Preparation for Filming

The first task to be undertaken once the arrangements have been agreed is for the documents to be filmed to be identified. So far as filming is restricted to complete and easily identifiable series of records, the archive which holds the documents may be expected to undertake the identification. However, when quantities of individual items within several series have to be identified, it may be unreasonable to expect the holding archive to undertake the identification. In such circumstances, it is more appropriate for representatives

of the archive which wishes to acquire copies to do so.

When the documents to be filmed have been identified, the holding archive should be responsible for the preparation of the documents for filming. This could include but not be limited to the following items:

- arranging any loose papers in their proper order
- numbering, foliating or paginating (or checking the existing numbering, foliation or pagination of) the documents to be copied, whether these are bundles of loose papers, volumes, files or other assemblages
- weeding or flagging duplicates and other material that should not be filmed
- removing fasteners and attachments such as paperclips, staples and pins
- disbindning tightly bound or brittle volumes that cannot be opened flat for filming or adequately filmed in a book cradle

The parties should agree whether selected items from assemblages or only complete assemblages are to be filmed. It should be borne in mind that the former will increase the real cost of filming. Where only selected items from an assemblage are to be filmed, appropriate targets should be prepared to indicate what has been omitted.

Documents should be filmed in sequence in accordance with the archival order established in the institution which holds the originals, thus making possible the use of existing inventories of those originals. The institution holding the originals should make copies of any such inventories available to the archive seeking the copies as a basis both for identifying documents for filming and for inventorying the microform copies. The insertion of reel or fiche identification codes into copies of the inventories of the originals will transform them into inventories of the microform copies. Where no inventory of the original documents exists, or where the selectivity of filming makes them inadequate, the preliminary arrangements should include agreement on the responsibility for making an inventory of the microform copies.

3. Choice of Type and Kind of Microform

Before filming commences, it should be clear to all parties what type and kind of microform are to be supplied. These should be appropriate to the intended pur pose and consistent with the availabilit,v of suitable storage and other facilities.

3.1 Type of Microform

Silver halide microforms can last for several hundred years with no

significant degradation in image quality if stored in archival conditions, but are liable to damage if handled frequently and without proper care. *Dry silver film, vesicular film and diazo film,* on the other hand, are not regarded as being of proven archival quality, but if stored in appropriate conditions may have a life of between 25 and 100 years. Dry silver film is sensitive to heat and light, vesicular film to heat and diazo film to light. Both vesicular and diazo film is subject to fading when exposed to ultra violet light.

Positive silver halide and vesicular film are polarity (or sine) reversing (ie copying a negative produces a positive image), while diazo and special reversal negative silver halide microforms are polarity (or sine) retaining (ie copying a negative produces a negative image).

Filming in black and white should only be on silver halide negative film stock. The base material should normally be polyester (polyethylene terephthalate). Cellulose ester (acetate) is also a base material with good permanence but it can, if not properly stored, degenerate by liberating free acetic acid. The quality of the silver halide negative film should be in accordance with standards (ISO 10602).

Recommended type of microform for filming in black and white

The master negative. Should always be produced on archival quality silver halide stock, even when the recipient archive cannot maintain the appropriate environmental conditions for its archival preservation. In such circumstances, it may be advisable for the recipient archive to accept an intermediate master or viewing copy, leaving the master negative to be stored in a proper environment by the producer. Some national archives make it a condition of supplying copies that they retain the master negative. It is important, therefore, that the ownership and custody of the master negative should be determined as part of the preliminary arrangements.

Intermediate masters. May be on silver halide. Vesicular or diazo film is not recommended as an intermediate master. A balance will have to be struck between the relative cheapness and greater robustness of the diazo and the archival quality of the silver.

Viewing or dissemination copies. Similar considerations apply in selecting the type of copies film as for intermediate masters. Where hard wear is anticipated and optimum environmental conditions cannot be guaranteed, vesicular stock would be the recommended film stock for viewing copies. Otherwise diazo film is a good choice.

There are master negative film stocks that are not approved for archival purposes. Care should be taken to avoid these film stocks. The raw stock

should have been kept in proper environmental conditions. Out-of-date stock should not be used.

Filming in colour can be necessary for example when the colour of the records in mind carries unique information. In those cases a silver dye bleach microfilm (direct positive) on polyester, like Ilfochrome Micrographic Film, can be a good alternative.

3.2 Kind of Microform

An appropriate combination of polarity retaining or polarity reversing intermediate masters and viewing copies should be selected to give negative or positive viewing copies as appropriate.

The choice between negative and positive viewing copies is dependant upon the type of viewing equipment available. Positive copies are sometimes regarded as preferable for viewing on front-projection readers; negative copies are regarded as preferable for viewing on rear-projection readers. Ergonomics has also proven that there is less eyestrain from a negative image then from a positive image. Print-out from many types of reader-printers requires a negative microform to produce a positive hard copy, although some reader-printers can produce positive copies from either negative or positive microforms.

The choice between roll microfilm and microfiche (105 mm roll microfilm cut into pieces of 148 mm) will be determined partly by the availability of the appropriate viewing equipment, but mainly by the nature of the documents to be copied. Roll microfilm cameras are more flexible than microfiche (step-andrepeat) cameras, giving wider options on reduction ratios and filming positions, and are generally to be preferred for filming manuscript materials. Microfiche is more suitable for filming printed materials of standard size and density. An option which combines the flexibility of roll film with the compactness of microfiche is jacketed 16 mm microfilm, duplicates of which have the appearance of microfiche. Another way is the optical conversion from roll film to microfiche. Special techniques and types of film are required for copying maps, technical drawings and other outsize documents.

The choice between 16 mm and 35 mm roll microfilm may also be determined by the availability of appropriate viewing equipment. Earlier 35 mm film was to be preferred for copying manuscripts because then the 35 mm camera equipment had superior resolution qualities at a wider range of reduction ratios. With a reduction limited to x24 there was not space enough on a 16 mm film for larger manuscripts. Today, the resolution quality of 16 mm cameras is acceptable for copying manuscripts of standard format using higher reduction ratios (normally x48). Because of differences in size and condition

of the manuscripts 35 mm microfilm is often recommended for archival materials. 16 mm film may be cheaper: the cost of "raw" 16 mm film is less than that of 35 mm film and, since 16 mm film can contain more frames per roll, so is the cost per frame of duplicating. However, the filming costs per frame will be the same as for 35 mm film if a planetary camera is used. Rotary cameras, which operate automatically and with 16 mm film, operate film at a much higher speed but can be used only for filming non-brittle archival material of a smaller size which is in good physical condition.

4. Filming

Filming should be undertaken in a way that ensures the full legibility of the resulting microform. This should include balancing the lighting and exposure to achieve optimum density (ie the measurement of the blackness of the image), checking and adjusting the resolution (ie the measurement of the sharpness of the image), and selecting the reduction ratios appropriate to the sizes of the documents to be filmed and the size of their texts.

If the film is intended to be digitized in the future, this had to be considered when the quality of the filming (density, resolution and reduction ratio) is decided.

Titles and other information targets should be provided in conformity with commonly accepted practices and standards.

5. Processing

Processing of the silver halide camera master negative should be undertaken in conformity with the relevant international standards (ISO 10G02).

Standard tests should be conducted by the producer to confirm that the film processor is properly calibrated and the associated chemicals are properly mixed. This is done by running an "approved control strip" of film through the processor at the beginning of every job, to ensure that the desired density and contrast are achieved. The results of this test should be entered into a process control log as confirmation of adherence to this procedure. Process control logs should be kept for viewing by the archive. This will help to ensure that optimum density and contrast has been achieved and that the chemical processing has been properly completed

Care should be taken that no residual hypo (sometimes called thiosulphate or fixer) or excess silver that was not developed dur

processing is left on the film. The presence of excess residual hypo will promote the creation of blemishes and may adversely affect the images. The presence of unprocessed silver will eventually cause an image to blacken. The producer should conduct tests to ensure that the film is free from these conditions. The test rhat should normally be conducted to measure residual hypo is the Methylene Blue test (ISO 417). This test has to be done within 14 days after exposure of the film. Another test described in ISO 417 is the Silver Sulphide test. In rare cases test can be made for excess silver. The "Kodak Residual Silver test" could be used for this. However, in actual practice, if the Methylene Blue test comes out within parameters the test for silver should not be needed.

Where the producer is a commercial bureau, it may be advisable for the tests to be conducted by an independent agency and records kept.

6. Checking

The producer of the film should not only undertake the tests necessary to ensure the quality of the processing, but also check each microform frame-by-frame for:

- evenness of focus and density across the frame
- sharpness and clarity of the image
- proper titling information
- proper targeting of faults and any omissions
- proper sequence of documents and absence of unintentional omissions
- absence of mechanical damage resulting from faulty camera or processor equipment

Any completely unsatisfactory microform should be refilmed. Where only individual frames of roll microfilm are defective, the items, folios, or pages concerned should be refilmed and the new film, after checking, should be spliced at the beginning or end of the film with appropriate targets to instruct the viewer where the retaken images should appear in the document. If film on both polyester and cellulose ester bases are produced, two different types of splicers will sometimes be required: an ultrasonic splicer for the former type and a heat and pressure welder for the latter. However, a well adjusted ultrasonic splicer works in both cases.

In addition to the general check for evenness of density across the frame, it is essential that variations in density between frames of the master of a roll film should be measured so appropriate changes in exposure may be effected within the duplicator to ensure evenness of density throughout the duplicate film. If wide density variations do occur, a retake may be necessary. Since a

duplicator can only reproduce a limited range of density, information will be lost from the image if its density varies too widely.

7. Duplication

Yhe master negative should never be used for viewing. Its only purpose in duplicacion is to produce second generation copies, normally called intermediate masters.

An intermediate master should be produced and used as a printing master where more than a small number of copies will be required for viewing or dissemination, or where the producer is to retain the master negative but the archive seeking the copies has the facilities and authorization to produce its own copies. This intermediate master also should never be used for viewing.

There is available direct duplicating film which creates a negative copy from a negative master. A second generation copy of the master negative on silverhalide stock with polarity retaining will be acceptable. Where possible the archive should insist on a second generation negative film. The second generation intermediate master will be of better quality than a third generation negative (ie via an intermediate positive) on ordinary silver halide.

The making of duplicates from the master negative may be undertaken by the producer of that master negative, by the recipient or by a third party. Any responsibility by the producer to supply duplicates, or any restrictions on the freedom of the recipient to make such duplicates, or to have them made by a third party, should be covered in the preliminary agreement.

In deciding what type of duplicates are required, the recipient should consider the kind of use which is to be made of them. This will determine whether he requires:

- negative or positive copies
- copies on silver halide, diazo or vesicular stock
- roll film on 16 mm or 35 mm stock, or microfiche

There may need to be a conversion process if the original film is 35 mm and the need is for 16 mm or fiche. In many cases this can be done only by an outside service provider.

Duplicate microforms should be subject to the appropriate chemical tests and physical checks, though the same detailed frame-by-frame inspection should not be necessary where the quality of the master is assured, its density has been properly measured and the duplicator is working correctly.

Care should be taken that the duplicator is properly adjusted and is

producing the best possible duplicates. Care should also be taken that all images conform with ISO 8225 (diazo film) or ISO 9718 (vesicular film).

8. Storage and Handling

Microforms will definitely decay if they are stored in unsuitable environmental conditions. High temperature in combination with high relative humidity can be especially damaging. The several layers which make up a microform differ in their reactions to high humidity and temperatures. The gelatin image layer may craze or even separate from the carrier film. A combination of high temperature and high relative humidity also provides suitable conditions for the growth of mould or bacteria, often called blemishes, on the gelatin layer. In countries where conditions of high temperature and high humidity or varying temperatures and high humidit,v exist, special care should be taken with microform collections. Too many stories have been told of whole collections of microforms being unusable after only a few years of storage in unsuitable conditions.

8.1 Environmental Conditions

Microforms should always be preserved in conditions that satisfy the recommendations of the relevant international standards (IP~O 5466). An essential provision of these standards is that appropriate and stable environmental conditions should be maintained in the area within which the microforms are to be stored.

Temperatures and relative humidity for the storage of black and white;/ilms

Temperatures for:

archival storage	1 3°C ±2°C	Maximum that can be allowed without risk of damage the film is 21 °C.
medium-term storage	25°C	Normal maximum. Peak temperature not to exceed 32°C

Note: *It is important that the temperatures for any of these kinds of storage should be maintained at a stable level. The temperature for archival storage is based on praaical considerations. For exemple, there is no need for special measures when microfoms are removed temporarily from the storage area, except that they should be allowed to readjust to the new conditions before use to avoid moisture condensation on the film.*

Relative humidity for:

archival storage	Silver halide	cellulose ester base 15 to 40% polyester base 30 to 40%
	Diazo	15 to 30%
	Vesicular	15 to 50%
medium-term storage	Silver halide	cellulose ester base 15 to 60% polyester base 30 to 60%
	Diazo	15 to 50%
	Vesicular	15 to 60%

Note: *A base level within the appropriate recommended range should be selected and relative humidity maintained within +5% during a 24 hours period.*

Recommendations

- Maintaining the appropriate levels of temperature and relative humidity in tropical countries will almost certainly involve the use of air-conditioning equipment. A small store room with windows or wall-mounted, stand alone units is preferable to the use of an area served by central air conditioning. If external relative humidity is so high, whether continuously or only at certain seasons, that the air-conditioning equipment cannot maintain relative humidity within the storage area below 40%, it should be supplemented, when necessary, by a de-humidifier, which should be of the electrical, not the silicagel, type. If there is no current available, a stand by generator should be provided for the air conditioning units and de-humidifier.
- Silver-halide master negatives should be stored at a stable temperature that should not exceed 21°C and should preferably be much lower (see above). Relative humidity should be 30%-40%. Where several types of silver halide film are stored within the same areas, the recommended relative humidity is 30%. In all cases, rapid fluctuations of relative humidity should be avoided. If external environmental conditions are so dry as to make the attainment of a stable relative humidity above 30% virtually unattainable, a standard of 20% +5% is permissible provided that all the film to be stored is on cellulose ester stock. Polyester-based film cannot be kept at relative humidity below 25% without risk of the base layer separating from the carrier. To avoid mould it is necessary that the film should never, even for a short period, be stored in a relative humidity above 60%.
- Silver halide intermediate masters should be preserved in conditions that

approximate to those for silver halide master negatives, though maximum temperatures of up to 25°C may be acceptable provided that the relative humidity is maintained within the recommended range. Peak temperature for short periods must not exceed 32°C. Duplicate masters on diazo or vesicular stock should be subject to the same temperature controls, and their relative humidity maintained within the recommended ranges. It is recommended that diazo and vesicular films should not be stored together with silver halide film made for archival purposes. Diazo stock is not recommended where relative humidity cannot be readily maintained below 30%. Where relative humidity above 30% cannot be readily maintained, silver halide stock on a polyester base should be avoided.

- Viewing or dissemination copies should also be preserved in a stable and controlled environment if their continued usability is to be guaranteed.
- The temperature for archival storage of colour films shall be 2°C or below, and the relative humidity 15%-30% (cellulose ester base) or 25%-30% (polyester base).
- The storage environment for all types of microforms should be free of dirt and dust and of atmospheric pollution, especially sulphur dioxide fumes from automobile exhaust emissions, power stations or other plants which consume fossil fuels. It has been confirmed that silver halide masters subjected to these types of oxides will develop blemishes on the film base.
- Where environmental conditions in the area in which microforms are to be copied or consulted cannot be maintained at the same levels as those provided in the storage areas, and especially when low storage temperatures are maintained, microforms should be allowed to readjust to the new conditions before use. This is especially important for cellulose ester stocks stored in a very dry climate (15%-20%). If the storage temperature is below the dew point of the air, condensation of moisture can appear on the film unless the container is brought above this point before the film is removed.

8.2 Shelving, Containers and Inspection

Microforms should be stored in appropriate cabinets. Open shelving can also be used, but, if used, care should be taken to ensure that all oxides are filtered from the storage facility.

Roll microfilm should be wound tightly, but not under extreme pressure, on spools or reels. The film should not project beyond the edges of the flanges of the spool or reel and should be held securely by a thin card collar tied with string; elastic bands must not be used to prevent unwinding. Roll microfilm should be stored with the reel or spool upright, standing on the edges of th flanges; microfiche should be stored vertically. Master negatives on roll film an fiche should be stored in acid free boxes and envelopes respectively to provid protection against dirt and dust and physical damage. Viewing copies on ro~ microfilm stored on cartridges (single spindle) or cassettes (double spindle) ar easier to mount on readers or reader printers than film on open spools or reels and are thereby better protected in use. However, cartridges and cassettes arl more expensive than spools or reels and boxes; readers and reader printers whicl accept them also tend to be more expensive and cannot be used for more thar one type of film container.

Microforms on cellulose ester base should not be stored in closed boxes.

The materials used for shelving microfilm spools and reels and microfilm and microfiche enclosures should be free from acidic, oxidizing and reducing agents. Suitable materials, as appropriate, are:

- non-corrodible metals, such as anodized aluminum or stainless steel, or steel which has been well protected by a corrosion-resistant finish, eg la quer (provided it does not give off reactive fumes, peroxides or exudations), tinning or plating
- paper with an alpha-cellulose content greater than 87%, a pH between 7.5 and 9.5 (7.0 for diazo film) and an alkali reserve of at least 2%
- polyethylene

Any adhesives used should not affect the photographic image.

If there are questions about the quality of any of the materials, it would be wise to have them tested by a testing laboratory to see if the materials contair harmful materials (ISO 10214).

A representative sample of the microforms in storage should be inspected a two-yearly intervals. If deviations from recommended temperature and relativ~ humidity ranges have occurred, inspection should be at more frequent intervals. A sampling plan should be established in advance, so that a different batch is inspected each time. Deterioration of either microforms or their enclosures should be noted, the cause of the problem should be determined, and corrective action should be taken. Once deterioration has been identified, the roll of film should be print mastered and the original should be retired.

8.3 Handling

The master negative and any intermediate masters intended for further copying should be handled as infrequently as possible and always with great care. Lintfree cotton gloves should be worn, films should be handled only by their edges and equipment should be kept clean and well-maintained.

Viewing and dissemination copies do not require the same absolute standards of handling. However, careful use on clean and well-maintained equipment will help to prolong their working lives.

9. Access and Use

The conditions governing access to the copies to be supplied to the receiving archive should be agreed in the preliminary arrangements. These should be similar to those gaining access to the records in the producing archive.

The receiving archive should possess as a minimum two readers or reader printers, one of which should be restricted to staff use.

A wide variety of readers are available on the market and the choice between readers is very much a matter of availability, cost and personal preference. Readers fall into two basic categories:

a) front projection in which the image is projected on an opaque screen, usually presented to the user at a fairly shallow angle at desk level enclosed on three sides. This gives these readers greater acceptability in fairly high ambient light situations and is said to cause slightly less eyestrain

b) back projection in which the image is presented on a translucent screen similar to a television picture presentation; such machines are more numerous than the front projection models and are generally less expensive. Most microfiche readers are of this type. Because they are less complicated than roll film readers, they tend to be cheaper.

If roll film is to be held, the receiving archive also needs a rewind bench for inspecting film and a splicer for repairing damaged film (See chapter 6).

10. Further Reading

10.1 International Standards

ISO 5-1	Photography – Density Measurements – Part 1: Terms, Symbols and Notations. First Edition (1984)
ISO 5-2	Photography – Density Measurements – Part 2: Geometric Conditions for Transmission Density. Third Edition (1991)
ISO 5-3	Photography – Density Measurements – Part 3: Spectral Conditions. Second Edition (1995)

ISO 5-4	Photography – Density Measurements – Part 4: Geometric conditions for Reflection Density. Secondo Edition (1995)
ISO 417	Photography – Determination of Residual Thiosulphate and Other Related Chemicals in Processed Photographic Materials – Methods Using lodine Amylose, Methylene Blue and Silver Sulphide. Second Edition (1993)
ISO 1116	Microcopying – 16 mm and 35 mm Microfilms, Spools and Reels. First Edition (1975)
ISO 3334	Micrographics – ISO Resolution Test Chart No. 2 – Description and Use. Second Edition (1989)
ISO 5466	Photography – Processed Safety Photrografic Films – Storage Practices. Third Edition (1992)
ISO 6200	Micrographics – First Generation Silver-Gelatin Microforms of Source Documents – Density-Specifications. Second Edition (1990)
ISO 7225	Photography – Ammonia Processed Diawo Photographic Film – Specifications for Stability. Second Edition (1995)
ISO 9718	Photography – Processed Vesicular Photographic Film – Specifications for Stability. Second Edition (1995)
ISO 10214	Photography – Processed Photographic Materials – Filing Enclosures for Storage. First Edition; (Corrigendum 1-1992)
ISO 10602	Photography – Procesed Silver-Gelatin Type Black - and-White Film – Specifications for Stability. Second Edition (1995. Replaces ISO 4331 and 4332)

10.2 Other works

C. GOULARD, *La conservation des microformes,* CNRS - CDST, Paris 1983

M.J. GUNN, *Manual of Document Microphotography,* Bytterworths, Focal Press, London and Boston 1985.

A. HORDER, *Guidelines for the Care and Preservation of Microforms in Tropical Countries*. Unesco, Paris 1990 – PGI – 90/WS/17.

C. KECSKEMETI-E. VAN LAAR, *Model Bilateral and Multilateral Agreements and Conventions Concerning the Transfer of Archives,* Paris, Unesco, 1981 – PGI – 81/WS/3

J.A. KEENE-M. ROPER, *Planning, Equipping and Staffing a Document Reprographic Service: a RAMP Study with Guidelines,* Paris, Unesco, 1984 - PGI - 84/WS/8.

Manual of Archival Reprography, edited by L. KÖRMENDY, München 1989 (ICA Handsbooks 5).

Preservation Microfilming: A Guide for Librarians and Archivists edited by N.E. Gwinn for the Association of Research Libraries. American Library Association. Chicago 1987.

RLG Archives Microfilming Manual, edited by N.E. Elkington, The Research Libraries Group Inc. Mountain View, California 1994

C.H. SUNG, *Archives and Manuscripts: Reprography*, SAA Basic Manual Series (Society of American Archivists), Chicago 1982.

BÖRJE JUSTRELL
National Archives, Sweeden

MICHAEL ROPER
Public Record Office, London

HERBERT J. WHITE
Genealogical Society of Utah

AN INTRODUCTION TO DIGITAL IMAGING FOR ARCHIVES

Sempre di più le amministrazioni pubbliche, le comunità scientifiche e professionali, gli istituti di ricerca, le aziende si rivolgono all'immagine digitale per acquisire, conservare ed usare informazione. Anche gli archivisti cominciano a sperimentare la conversione della carta o del film nel supporto digitale. Lo studio, elaborato nell'ambito del Comitato per la tecnologia dell'immagine del Consiglio internazionale degli Archivi (ora Comitato per la tecnologia dell'informazione) intende pertanto fornire agli archivisti alcuni concetti fondamentali su questa tecnologia.

Lo studio riflette l'esperienza di tre attività ad essa connesse: la creazione di surrogati elettronici che rappresentino l'essenza della fonte documentaria originaria, la capacità delle infrastrutture tecniche di sostenere l'immagine digitale, la comprensione dei bisogni dell'utenza.

Introduction

Digital image technology represents a compelling new means for managing and retrieving information. Its growth takes advantage of the dramatic increase in the power and use of personal computers, the development of high speed, high bandwidth networks that are accessible to an increasing number of individuals and organizations worldwide, the declining cost of mass storage, the availability of quality production scanning systems, and the development of client/server architecture and the World Wide Web.

Increasingly, business, government, industry, the professional and scientific communities, and research institutions are turning to the use of digital image technology to capture, store, access, and use information. In addition to temporary records, a growing number of them are digitizing material of enduring value. Archivists, too, are beginning to experiment with the use of digital imaging to convert paper -and film- based records under their direct care.

The purpose of this brochure is to introduce archivists to some of the fundamental concepts of digital imaging. Our discussions will reflect three inter-related activities associated with the use of this technology: creating electronic surrogates that represent the essential attributes of original source documents, assessing the capabilities and current constraints of the technical infrastructure that supports imaging initiatives, and understanding and meeting users' needs.

What are digital images?

Digital images are "electronic photographs" taken of a scene or scanned from original source materials. In the case of the latter, digital images can

accurately render the information, page layout, and presentation of an original, including text, illustrations, annotations, and other evidence of age and use.

With digital imaging, a document is sampled and mapped as a grid of dots or picture elements ("pixels"). Each pixel is given a tonal value depending on the level of light reflected from the original onto an electronic, light-sensing integrated circuit, known as a charged couple device (CCD). The level of lightness, darkness, and/or color is digitally represented in binary code (zeros and/or ones). The binary digits ("bits") for each pixel are stored by the computer in a sequence, or reduced to a mathematical representation ("compressed"). The bits are then interpreted and read by the computer to produce an analog representation for display or printing.

1	1	1	1	1	1	1	1	1	1
1	0	0	0	1	1	0	0	0	1
1	1	0	1	1	1	1	0	1	1
1	1	0	1	1	1	1	0	1	1
1	1	0	1	1	1	1	0	1	1
1	1	0	0	0	0	0	0	1	1
1	1	0	1	1	1	1	0	1	1
1	1	0	1	1	1	1	0	1	1
1	1	0	1	1	1	1	0	1	1
1	0	0	0	1	1	0	0	0	1
1	1	1	1	1	1	1	1	1	1

Digital rendering of letter H where 0 represents black and 1 represents white

Why use digital technology?

Many archives are considering whether to invest in digitizing records and in determining which records to convert. Among objectives associated with digital imaging projects already underway in archival repositories are the following:

- to make records more accessible by improving retrieval
- to make records more useable through management and incorporation into electronic databases
- to distribute copies of records electronically
- to enhance descriptive access to records
- to build "virtual" collections from the holdings of multiple repositories
- to save space by miniaturizing the records

- to preserve the intellectual contents of deteriorating records
- to ensure better security for original records
- to provide paper copies on-demand more efficiently and with higher quality
- to better understand the technology so that archives can knowledgeably acquire these records
- to increase public awareness of the institution
- to control operating costs
- to generate revenue

Representative Archival Imaging Initiatives

The National Archives of Canada is digitizing its holdings of cellulose nitrate negatives so that the original negatives can be withdrawn from circulation and frozen to improve their preservation. The digital images of the negatives will be accessible on line both locally and remotely, pending copyright and intellectual access restrictions. This project has both preservation and access components.

The Archivo General de Indias in Seville, Spain has digitized eleven million pages documenting the Spanish colonization of the Americas. This project has improved storage and security for the original documents, has made the records more accessible, and has increased national and international awareness of the institution.

The Library of Congress (U.S.) has established the National Digital Library Program which has as its primary focus the conversion of historical collections to digital form. During the next five years, the Library plans to convert five million items, including manuscripts, photographs, books, and pamphlets and to make this material network accessible.

The British Library has created a full color electronic facsimile of the Beowulf Manuscript and related documents. Image files, from black and white, to color, to ultraviolet, provide better access to parts of the manuscript than study of the manuscript itself. Test images are accessible via the internet from the British Library and the University of Kentucky.

The State Library of New South Wales, Australia, has digitized 8,000 manuscript pages that relate to the botanist Joseph Banks, who accompanied Capt. James Cook on his voyage of discovery to the South Pacific. The complete archives will be available via the internet by the end of 1996.

Digital imaging: advantages

Digital images offer tremendous advantages over analog counterparts in terms of capture, duplication, storage, and transmission. A digital image can record with high fidelity the informational content of an original document and subsequent copies of that digital image can retain that same quality. Digital images can be transferred over networks for remote, simultaneous, and multiple access. The images themselves can be manipulated: panned, zoomed, even processed through such technologies as Optical Character Recognition software (OCR). Their use in research and cultural institutions represents the potential to save costs over taditional forms of service and to minimize space requirements.

Digital imaging: disadvantages

The promise of digital imaging may be bright, but there are a number of drawbacks that currently limit its utility in archival repositories, including:

- rapidly changing technological base
- transitional period in which the traditional and the new must be fully supported
- legal constraints, including privacy, copyright, and donor restrictions
- lack of standards
- recopying, storage, and migration requirements
- lack of institutional commitment and capability to provide continuing access to digital objects over time
- lack of vendor support and stability

Although these disadvantages can be daunting, archival repositories should begin to consider digital imaging initiatives now so as to develop and awareness of the capabilities and constraints associated with this technology and to prepare themselves to manage materials digitized by others that become their ultimate responsibility.

KEY COMPONENTS OF AN IMAGING PROGRAM

Once the commitment has been made to initiate a project, decisions will need to be made in several key categories.

This is true regardless of the size and scope of the effort, from the creation of a single CD-ROM to the full retrospective conversion of the entire contents of a repository.

Each project will involve four major activities: conversion, collection management, presentation, and enduring access.

1. Conversion

Know your documents

The goal of any imaging program should be to capture and present in new formats the significant informational content contained in the original source documents. James Reilly of the Image Permanence Institute at Rochester Institute of Technology (U.S.) puts it best when he tells his audience to "love your documents." He suggests choosing a representative sample of documents and, in consultation with those with curatorial responsibility, to identify key features that are critical to the documents' meaning. As one becomes a connoisseur of the original, the task of defining the value of the digital surrogate becomes one of determining how well it reflects the attributes of the original. Quality assessments of digital images should be based ona comparison between the digital images and the original documents–not on some vaguely defined concept of what's "good enough," or how well the digital files serve immediate needs. If the digital image is not faithful to the original, what is sufficient for today's purposes may well prove inadequate for tomorrow's. Consider, for example, that although photographs scanned at 72 dpi often "look good" on today's computer monitors, this resolution shortchanges image quality in a printed version, and will likely be inadequate to support emerging "visual searching" techniques.

Characterize documents by their physical attributes

Digital image capture must take into consideration the technical processes involved in converting from analog to digital representation as well as the attributes of the source documents themselves: dimensions, level of detail, tonal range, and presence of color. Documents may also be characterized by the production processes used to create them, including manual, machine, photographic, and more recently, electronic methods. All paper- and film-based documents will fall into one of the following four categories which will affect their digital recording:

- *Text/line art:* Distinct edge-based representation, with no tonal variation. Usually monochrome. Can be produced by hand, typescript or machine printing. Includes texts, manuscripts, line drawings, woodcuts, typed or laser printed documents, blueprints, maps, and music scores.
- *Continuous tone:* Smoothly varying gradation of tones. Monochrome or color. Includes photographs and some original art work (e.g., charcoal sketches, watercolors), as well as graphic art that is produced with continuous tone-line attributes, such as aquatints, lithographs, and collotypes.
- *Halftone or halftone-line:* Regularly spaced pattern of dots or lines, often

placed at an angle. Monochrome or color. Includes graphic art that is created using a fine and highly regular pattern of lines or hatchmarks, e.g.; line engravings and etchings.

• *Mixed:* Contanis both text/line art and continuous tone or halftone. Monochrome or color. Includes newspapers, magazines, illustrated books.

Understand how digital technology maps to document characteristics

Document attributes will in large measure determine the range of appropriate scanning choices. Use a scanner that "fits" the document: (1) in terms of being able to accommodate the physical dimensions of the original or the media type (transparent vs. reflective), and (2) in terms of being able to accommodate the range of document detail, tone, and color.

Recommendations:

Single leaf, regular-sized documents (≤ 11" x 17")
• flatbed scanners
• non-damaging, production sheetfeed scanners

Single leaf, oversized material
• drum scanners
• specialized sheetfeed scanners
• digital cameras

Bound volumes
• right angle, prism, and overhead flatbed scanners
• digital cameras

Transparent media
• slide scanners
• microfilm scanners
• some flatbed scanners
• digital cameras

Flatbed scanners are the most common scanners available on the market. They resemble photocopiers in which the document is placed face down on a platen for copying. Principal advantages include: direct scanning from original, wide range of image enhancement capabilities, availability and cost. Principal disadvantages include: document dimensions limited in size, usually no greater than 11" x 17"; no control over lighting and limited capability to capture the full range of tones from lightness to darkness (expressed as its dynamic range); not suitable for fragile or very light sensitive material. Prices range from below $500 to over $50,000.

Sheetfeed scanners use the same technology as flatbeds, but the document is fed through the system via roller, belt, drum or vacuum transports. The advantages of sheetfeed scanners include very high volume and speed of throughput and the capability to perform simplex or duplex scanning. Disadvantages include those of flatbed scanners, plus limited image enhancement capabilities and an emphasis on production over quality. Prices range from $5,000 to $15,000.

Drum scanners are designed for the graphic arts market. They offer very high resolution and excellent capture of tonal and color variation. The disadvantages of drum scanners include the expense, slow throughput, and the need for highly skilled operators. Prices range from $10,000 (desktop) to over $100,000.

Digital cameras resemble light-lens cameras and combine camera optics with scanning technology. They enable the direct scanning of originals of unlimited size and shape; high resolution is possible through sampling the document and stitching the samples together. They offer good control over lighting and represent a non-destructive book scanning capability. Disadvantages include their slow capture speed and throughput, the need to control lighting precisely, and high operator skills. Prices for high end models range from $20,000-$75,000.

Slide scanners are used exclusively for transparent art or photo-intermediates of reflective originals. They offer the advantage of being able to capture any document that has been copied to a slide, and they provide good capture of dynamic range. Disadvantages include: for photo-intermediates, the digital image is two generations away from the original document and the quality of the slide will affect the quality of the digital image; resolution may be insufficient to record fine detail and recording speeds are slow. Prices range from $5,000-$50,000.

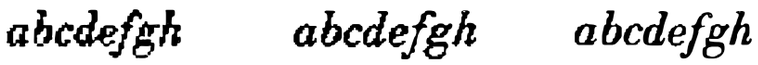
Microfilm scanners are used to convert roll film, fiche, and aperture cards. They offer the same advantages as slide scanners and the same disadvantages, although throughput is often higher with microfilm scanners. Given the amount of preservation microfilming that has occurred, microfilm scanners have strong library/archival applications. Prices range from $10,000-$250,000.

• drum scanners

In addition to accommodating the physical dimensions of source materials, scanner hardware and software offer a range of capabilities for capturing detail, tone, and color. Taking into consideration a document's attributes, the following six factors together will determine the quality of the resulting digital file: resolution, bit depth, image enhancement, compression, equipment used, and operator judgement.

Resolution is determined by the number of dots or pixels used to represent an image, expressed in dots per inch (dpi) or pixels per inch (ppi). Increasing

the number of pixels used will result in a higher resolution and a greater ability to record fine detail, but will also lead to a geometric increase in file size:



200 dpi *300 dpi* *600 dpi*

Recommendation: choose a resolution that is sufficient to capture the finest significant details contained in a group of documents. Set the resolution at this level for the entire group of documents so as to avoid the labor and expense of item by item review at the point of scanning.

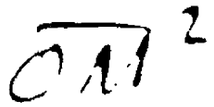
Bit depth is determined by the number of bits used to define each pixel. The greater the bit depth, the greater the number of gray or color tones that can be represented. Bit depth can also affect resolution requirements and will increase file size arithmetically.

3 bits of gray

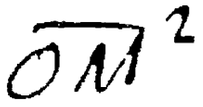
8 bits of gray

Recommendation: choose a bit depth that is consonant with the characteristics of the source documents. If they consist of black ink on white paper, black and white (1-bit) scanning should be sufficient. If documents contain significant grayscale information, choose grayscale (8-bit) scanning. If documents contain significant color information, choose color (24-bit) scanning.

Image enhancement processes can be used to improve image capture – even at the pixel level – but their use raises concerns about fidelity and authenticity. Typical enhancement features include filters, tonal reproduction curves, and color management tools.



600 dpi 1-bit, unenhanced

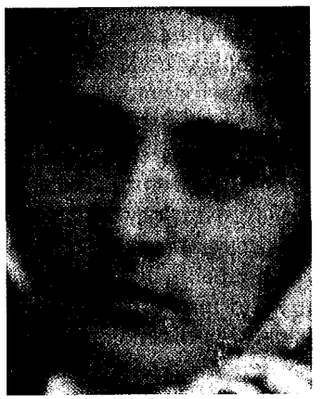


600 dpi 1-bit, with sharpening filter used

Recommendation: Apply enhancement processes conservatively and document all processes used. The U.S. National Archives and Records Administration suggests maintaining both an unenhanced image as well as an enhanced copy.

Compression is used to reduce image file size for processing, storage, and transmission. Image quality may be affected by the compression techniques used and the level of compression applied. Compression techniques may be characterized as "lossless" in which no information is thrown out in reducing the file to a matehmatical shorthand; and "lossy" in which the least significant information is averaged or discarded in the process of reducing the file size.

No compression, magnified 5x



19:1 JPEG lossy compression, magnified 5x

Recommendation: Use lossless, standard compression techniques in creating a digital master image. For 1-bit images, consider ITU Group 4 or JBIG compression; for multi-bit images, consider lossless JPEG or LZW.

The equipment used and its performance over time can have a pronounced impact on image quality. Different scanning technologies can perform differently, even when they offer the same technical capabilities (resolution, bit depth, enhancement techniques, throughput).

Recommendation: Manufacturers' claims of system capabilities should be carefully investigated and confirmed through sampling. Check with other customers regarding the system's performance over time.

Operator judgement and care, as with other means of conversion, can have a tremendous impact on achieved image quality. If care is not taken at the point of scanning, images can be too light or dark, can be skewed, blurred, incomplete, or omitted.

Recommendation: A continuous quality assurance program should be implemented to verify consistency of output for all scanning techniques employed.

A suggested conversion strategy: full informational capture

Scanning resolutions, bit depth, and enhancement techniques can represent a complex tradeoff between image capture time, expense, file size and compression ratios, fidelity, and utility for on-screen display or printing. Increasing resolution or adding gray/color adds to scanning, processing, storage, and access times, places a higher demand on system requirements, and can increase costs dramatically.

Conversion decisions should be made at the macro level to achieve maximum production and minimum cost for a given quality. Set quality requirements high enough to avoid the expense of item level review and the need to rescan material at a later date because the file is not rich enough to support user needs.

A conversion policy that adheres to the strategy of full informational capture will ensure high quality and functionality, while minimizing cost. The key is not to capture at the highest quality possible but to match the conversion process to the informational content of the originals – no more, no less. In

presenting this approach, we stress the need to know your documents, but also to recognize that a translation occurs when one moves from analog to digital and back again.

Create one scan to serve multiple uses

There are complling preservatio, access, and economic reasons for creating a "digital master" in which all significant information contained in the source document itself is fully represented. This digital master can then be used to serve a variety of current and future users' needs, from printing, to network distribution, to on-screen display, to data processing. We support our Australian colleagues who argue that not all digitized information should be saved and that resources should be devoted to retaining and preserving digital materials "only for as long as they are judged to have continuing value and significance" ("Draft Statement of Principles on the Preservation of and Long-Term Access to Australian Digital Objects"). We believe, however, that long-term value should be defined by the intellectual content of digital images, not by technical decisions made at the point of conversion.

If the digital image is used for *preservation* purposes, it is important to create a high-quality scan because the source document may only be available for conversion once. Digital images can serve as surrogates for the originals, which are then stored in a controlled environment. The image must be rich enough to reduce or eliminate users' needs to view the original. If the digital image is to replace the original (such as in office backfile conversion projects), the digital image must fully represent all significant information contained in the original, as the image becomes the source document and must satisfy all research, legal, and fiscal requirements.

Digital imaging is most often used to enhance *access.* A digital master should be created and used to derive multiple images and formats, because:

- users' need and computing capabilities vary – digital images should support all of those needs through derivative versions
- printing, display, and image processing requirements vary tremendously
- completeness, detail, and speed of output are often conflicting requirements
- the better the scan, the better the quality of the derivates
- user expectations will likely be more demanding over time; the digital master must be rich enough to accomodate future applications.

The *costs* of creating a high-quality digital image will be less than creating a lower quality image that fails to meet long-term needs. Digital imaging is expensive. Labor costs associated with identifying, preparing, inspecting, and

indexing digital information far exceed the costs of the scan itself. They key to cost containment is to avoid the necessity of rescanning at a later date. In recent years, the costs of scanning and storage have declined, closing the gap between high-quality and low-quality digital image capture.

The costs of archiving and migrating digital information over time are not insignificant, but they can be justified and met if the digital object has long-term value and its maintenance will lead to potential savings over traditional archival services. This will occur only if the digital version is rich enough to satisfy a full range of needs.

Guidelines for image capture

There are no standards for determining image quality for digital capture. Different document types (text/lineart, halftones, continuous tones, and mixed documents) will require different scanning processes. Acceptable levels of quality must be defined through careful assessment of both the attributes of the source documents *and* the capabilities of digital imaging systems, then confirmed by scanning representative documents and evaluating image quality on screen and in print. The use of resolution targets and grayscale/color patches provide additional means to monitor image quality.

The following guidelines for various categories of material have been suggested by institutions undertaking pilot imaging projects:

Archival documents

- typewritten/photocopy/laser printed/most ball point: binary adequate, 300 dpi minimum (U.S. National Archives and Records Administration)
- pencil/quill/felt tip: 200-300 dpi binary with gray (Cornell University, U.S.)
- damaged/stained/faded: 200-300 dpi binary with gray (Cornell University)
- papyri: 600 dpi, 24-bit color scanning (Advanced Papyrological Information System)

Note: The Archivo General de Indias computerization project utilized 100 dpi scanning with 16 levels of gray retained. Although the scanning did not result in the capture of all the information contained in the source documents, the objective to provide on-screen use has been met.

Photographs

- 8-bit grayscale or 24-bit color, resolution requirements dependent on quality and detail of original and levels of use to be supported.

Published text and simple line art

- 600 dpi bitonal for replacement quality (Cornell University) – resolution level sufficient to capture all significant information and avoid the labor and expense of item-by-item review.

Illustrated text

- 600 dpi bitonal scanning with enhancements – adequate for replacing most book illustrations where high contrast microfilm or photocopy is acceptable. For those items for which photocopy or microfilm is not acceptable, begin benchmarking with 8-bit grayscale or 24-bit color at resolutions between 200-400 dpi, depending on the level of detail present in the original. For color oversize maps, Columbia University (U.S.) has concluded that 200 dpi, 24-bit color scanning ensures legibility.

Halftones

- 600 dpi bitonal (descreened) or grayscale/color scanning at dpi equal to 1.5 times the screen ruling (Cornell University).

2. Collection management

Conversion with an eye towards optimizing image quality is only the first step in creating surrogates that will meet user needs. The extent to which access to archival materials will be enhanced also depends upon the level of associated indexing, as well as the technical infrastructure an institution will support. Programs designed to meet short-term goals may be driven by current user needs and the existing infrastructure, but long-term accessibility requires that provisions be made for meeting future user expectations as technologies improve. These might include:

- implementing or upgrading network distribution of image collections
- copying images to faster storage media when network capacities increase
- upgrading the functionality of the user interface
- delivering higher-resolution images to users for display or printing
- incorporating new information retrieval technologies (e.g., improved OCR programs for handwriting)
- migrating images to new file formats or media to ensure readability

To a certain extent, converting archival collections into digital form is a linear process: selection, preparation, conversion, arrangement and description, distribution, and use. Successful imaging programs, however, make provisions for the often non-linear interrelationships among the various analog-to-digital-to-analog processes that constitute the "digitization chain". Figure 1 illustrates

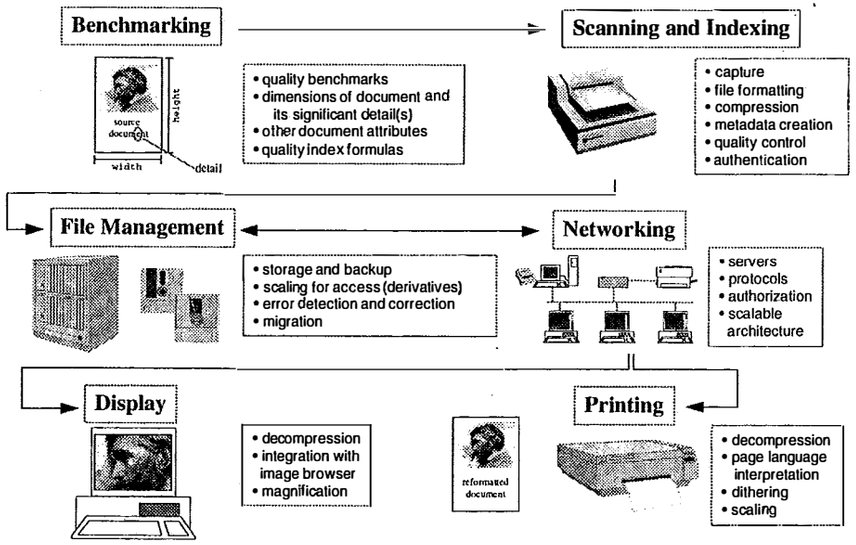


Figure 1. The digitization chain

the chain of decisions and activities that take place between source documents and their various digital surrogates.

The strength of each link in the digitization chain – from conversion to presentation and beyond – will depend upon the material selected, the anticipated uses of digital images, and the technical infrastructure supported. Tradeoffs must often be made between image quality and production, between timeliness and completeness, or between image utility and cost. Short changing efforts in one area can jeopardize overall system functionality. An over concern with user needs, current technological capabilities, image quality, or project costs alone may compromise the ultimate utility of digital collections. In an important user study, Peter Robinson noted that speed and quality are defined by the weakest link in the chain, and that maximum efficiency will be achieved when the links in the digitization chain are complementary (*The Digitization of Primary Textual Sources,* 1993, p. 4). For example, although it may be possible to capture the closely-spaced contour lines and small text from a map onto a Photo CD, these details will *not* be visible on low-end computers with insufficient memory to display the full resolution image.

Decisions made at any point in a digital conversion project reverberate in each subsequent step. We advocate full informational capture in the creation of digital images – and sufficient indexing at the point of conversion – as the best guarantee for providing the most flexibility further down the chain.

Bringing intelligibility to digital images

High-quality scanned images will be useless if they are stored without planning and concern for how they will be ultimately used. Fortunately, principles of archival arrangement translate well to organizing digital images – with the caveat that machine readability and interpretability issues must also be considered. Carl Lagoze, a computer scientist at Cornell University and leading researcher in digital library development, advises following three closely tied strategies to manage digital images and the descriptive information, or "metadata," that accompagnies them:

- *organize* the scanned image files into a disk hierarchy that logically maps to the physical organization of the documents
- *name* the scanned image files in a strictly controlled manner that reflects their logical relationships
- *describe* the scanned image files internally, using the image header, and externally, using linked descriptive metadata files.

Organizing images: create a disk hierarchy

At the outset of a project, strategies should be developed to arrange scanned images in a manner consistent with the originals. In other words, before considering the fileds that will be used to describe each image, use controlled vocabulary and a standardized scheme to name the locations in which the images will be stored. A simple directory structure for an archival record group is illustrated below:

Record Group
Series 1
Subseries A
Folder 1 Folder 2
Document 1, 2, etc. Document 1, 2
Series 2

Naming images: use standardized vocabulary

Computers are literal in interpreting names; they will not connect doc1.page1 and Document1.Page2 as the first two pages of a single document. It is essential to adopt uniform conventions for names, punctuation, and capitalization. Unix programs offer great flexibility in this area. Care should be taken when collating originals before scanning to ensure that the digital files

will be properly oriented, ordered, and named to reflect the correct sequence of the originals. Collation workforms identifying folder names and page ordering will help ensure a consistent approach during scanning.

Describing images

The type and availability of descriptive information, or "metadata," for digital collections will determine the level of retrieval that will be supported. When selecting materials for conversion, survey the availability and type of existing metadata in both hardcopy and electronic form. (Examples include finding aids, cataloging records, and indexes.) Also consider the time and expense that will be associated with using existing machine-readable information for indexing images. Do staff members have the needed expertise to incorporate this information, or would it in the end be less expensive to "re-key" the information into a new database?

Creating metadata to facilitate searching across image collections may satisfy end users of collections, but it is also important to consider donors, archivists, curators, and computer programmers as equally interested stakeholders in this enterprise. Metadata will also need to be created to document image specifications (e.g., horizontal and vertical pixel dimensions) that will be essential for batch processing of derivatives; to specify terms and conditions for access when restrictions apply; to identify the internal "structures" of documents (e.g., page ordering, enclosures, etc.) to facilitate quick browsing; or to describe the origin of a specific object, which is especially desirable when images from multiple repositories are co-located to form a unified virtual collection.

There is some discussion about whether metadata should be placed in the file header for each image or in separate text files that are associated with a single image or with a group of images. Either strategy may be appropriate to satisfy short-term requirements for retrieval, but, again, longer-term considerations should also be made with respect to how to migrate metadata efficiently and reliably when necessary.

Image databases and information retrieval

The key distinction to make between databases and information retrieval is that databases index on metadata, and information retrieval systems index on the data itself. If one considers the digital images themselves – with layout, illustrations, and typography intact – to be the "data," then, given the capabilities of current OCR technology, information retrieval will only be a viable option for documents containing machine-printed text. Databases, however, can be used to organize the metadata for any archival collection. The important governing principles in database design are generality and simplicity: the former promotes quick searching if similarities rather than differences among documents are highlighted; the latter increases user acceptance of digital collections as searching conventions can be easily learned, if not intuited.

Recommendation: determine the deepest level – series, folder, or item – to be searched; obtain or create the necessary metadata; and use an open model database to integrate searching and display capabilities in a single interface, preferably one that will support networked access in current or future implementations.

3. Presentation

The final links in the digitization chain that affect both image quality and throughput are the hardware and software used to present an analog version to the user, either on-screen or in print. As many imaging programs are designed to promote use of collections via computer screens, user workstations, and on-screen display will be discussed first.

Recommendation:

Minimum configuration for user access workstation:

- *CPU: 486 for PC, and 68030 or 40 for Macintosh*
- *RAM: 8 MB*
- *Hard drive: 500 MB+*
- *I/O and system architecture that matches or exceeds the data transfer speed of the network and peripherals*
- *Controller: IDE or SCSI (depending upon peripherals)*
- *14" monitor set to 800 x 600 pixels (72dpi), 72Hz refresh rate supported by video card, and 2MB of video RAM*
- *CD-ROM drive (local access), modem (telephone access), or network card (network access)*
- *1996 costs: approximately $1,500*

On-screen display

Access requirements will vary with the nature and extent of the digital collections and the needs of the users. (Scholars who study papyri, for example, prefer to look at small fragments magnified 9-10 times their normal size.) In general, users of digital collections share three interests with respect to on-screen presentation: legibility, completeness, and speed of delivery. Meeting all three criteria may not – and very likely will not – be possible by delivering the digital master to the screen. Scanned at 600 dpi 1-bit, the fine details in a 5" x 8" line engraving will be sharply defined on a conventional VGA monitor, but only 2.1% of the fimage could be displayed at a time, and it would take a researcher over 8 minutes to access that image using a high-speed modem. Displaying the "complete image" – no scrolling required – on the same screen would result in discarding over 97% of the information and limit image resolution to 60 dpi. This view compromises legibility, but access speed will increase tenfold. The trade off may be acceptable if researchers are interested in viewing a series of images quickly, but may not be sustainable for single-image review.

Scale images for on-screen display

The solution to the problem of satisfying a range of users with a range of technical capabilities and research needs is to create multiple versions from the digital master, and to deliver the "appropriate image" to a screen or printer on demand. Fortunately, rescanning is not necessary to meet this goal. *Scaling* is a process used to create access versions from a digital master to meet various users' needs. Unlike copying, scaling is a conversion process that produces an image which differs from the digital master. Scaling represents a balancing act between completeness and legibility, completeness and speed, and legibility and speed.

How many derivatives of each master image should be created to meet users' needs? Will printing be possible, or will users be expected to conduct all research tasks on-screen? Are there restrictions that preclude making high-resolution images accessible via the network? These and other questions must be answered on a collection-by-collection basis. Nevertheless, for access purposes, it will almost always be true that one image is not enough.

Scaling images for access requires a number of steps. The first is to determine the necessary resolution for images derived from the digital master. Choose a resolution that is sufficient to ensure the level of legibility required, e.g., recognition quality, reading quality, study quality. The resolution necessary for any level of legibility will depend on the fineness of the detail in the original document that must be represented in the on-screen version.

Once the resolution requirement has been determined, digital masters can

be scaled to the desired dpi. The quality of the resulting derivative will depend upon the routines used in scaling. Scaling algorithms vary from one software package to the next, but there are some basic steps that will apply across all programs. For example, we recommend adding grayscale to black and white images to enhance on-screen legibility.

The following recommendations are given as starting points for scaling master images.

Scaling bitonal images

- determine dpi for display
- create bitonal "working copy" by resizing digital master to a lower dpi
- increase bit depth to 8-bit gray
- blur image

The use of filters (blur, sharpen, or custom-designed filters for image types) is the most time-consuming step in the process, but crucial to achieving good on-screen image quality.

- resample to desired dpi
- sharpen according to your preference
- decrease bit depth, but retain some gray (e.g., 3 bits of gray for text/lineart and 4 bits or more for illustrations)
- save derivative in format compatible with the image brower that will be used

Scaling color and grayscale images

- determine dpi and bit depth for display
- create color or grayscale working copy by resampling digital master to a lower dpi (see above)
- blur image, if necessary (e.g., derivatives created from halftones and halftone-like images and significantly improved by using a blur filter in scaling, see next page)
- resample to desired dpi
- sharpen according to your preference
- decrease bit depth by changing file format (e.g., TIFF to GIF) or by using the optimum color/grayscale reduction methods allowed by the software

Evaluate effects of decreased bit depth, bearing in mind tradeoffs between image quality and file size. If quality is unacceptable, retain full bit depth.

Monitor and video card capabilities at the user workstation may also affect image quality, so derivatives should be evaluated on a variety of monitors whenever possible.

• save derivative in format compatible with the image browser that will be used

Figures 2 and 3:
300 dpi 8-bit engraving, secled to 100 dpi-bit two ways

Image scaled by using blur filter, resizing and reducing bit depth.

Image scaled by resizing and reducing bit depth only. No blur filter used.

Printed facsimiles

Digital images can be printed on a variety of printers, from inexpensive inkjet to highend copier-printers. Printer components include: printer and memory, color management software, file conversione utility, print server, and network.

Recommendations:

proof printing and reference quality prints
- inkejt
- laser

replacement copies
- laser
- copier-printer

halftones
- laser
- copier-printer

continuous tones
- dye sublimation

oversize (greater than 11" x 17")
- inkjet

In general, high quality printed facsimiles from digital images can be produced on laser printers for black and white images (ranging in cost from $800-$250,000 for production printers); copier printers, consisting of hardware/software configurations that enable standard digital color photocopiers to print digital images for grayscale and color images (via halftoning), which range in price from $72,00-$90,000; and dye sublimation printers, the only printing technology capable of true rendering of continuous tones (grayscale and color), ranging in price from $1,500 to $ 17,000+. The cost per print increases from as low at $.025/page with laser printing to $3.00+/print using a dye sublimation printer.

Networks

Networks range from the Local Area Network (LAN) that connects several computers in a single room to the global interconnected network defined as the Internet. The speed of delivery of digital images will be determined by network capacity (bandwidth of the slowest sub-network), network traffic, image file size, and means for presenting images and end-user computing capabilities. Network capacity is expressed as the total number of bits that can be transmitted per second. Maximum capacities of widely installed networks can vary tremendously, from 100 million bits per second on FDDI (fiber optic) to 10 million bits per second on Ethernet to 9,600 bits per second on a 9600 Baud modem. The transmission rate for an uncompressed image of a letter size page scaled to 100 dpi with 4 bits of gray will be delivered in .046 seconds over FDDI but will take 8.12 minutes to transmit over a standard modem! Timeliness of transmission at an institution must be carefully assessed prior to making digital image collections available for use over the network.

Issues to consider in system design:
- whether or not to provide access locally or remotely (i.e., stand-alone versus network access; and single versus distributed copies, for example by CD-ROM)
- number of users who will simultaneously have access to images
- interface issues (proprietary system or the Web; single or multiple platforms)
- levels of service (reference; print-on-demand, "publication quality images," 24 hour per day/7 days per week, continued maintenance of and access to originals)

Storage

Storage components consist of the media on which digital information is written, and the devices used to record, read, and process that information. In a mature digital imaging program, a third essential element is a well-defined

"deep infrastructure" (CPA/RLG Task Force) consisting of policies, staff support, and monitoring procedures designed to ensure the integrity, security, currency, and delivery of digital information.

Recommendations:

- utilize storage devices and media whose sustained write and/or read speeds ("Transfer rates") support throughput requirements throughout the digitization chain
- rely on multiple levels of storage for access, printing, archiving, and backup
- implement software and procedural solutions for batch storing (queuing) and retrieving (caching)
- invest in a scalable architecture that ensures adequaté growth and capacity rates while minimizing costs – buy media only as needed to take advantage of declining costs and increasing capacity
- consider both the costs of initial acquisition – including necessary computing upgrades (e.g., more RAM) – and maintenance

The following types of media are most appropriate to archival applications:

Magnetic disks

Hard drives

- applications: on-line storage of programs, indexing data, and access images
- advantages: highest speed media (response time in milliseconds); rapidly declining costs
- disadvantages: complex scalability – software and cabling needed to daisy-chain or link drives, and knowledgeable staff needed to maintain systems; shorter media life than optical

Removable hard drive cartridges (e.g., Iomega Zip, SyQuest)

- applications: downloading access images; moderate-speed transport medium between vendor and institution
- advantages: portability; low device costs ($200-400) and moderate media costs
- disadvantages: new technology with proprietary standards and little compatibility among vendors

Optical discs

WORM (Write Once Read Many)

- applications: secure, near-line storage for secondary access images; archiving of digital masters

- advantages: fast access; high capacity; legally admissible media, as data cannot be altered once written to disc; stability (100-year life)
- disadvantages: error verification not supported, lack of standards and compatibility (proposed ISO standard, Project 408-L for 12", and ECMA/ISO standard pending for 5.25"); comparatively low recording speeds; current trend is to move away from use of WORM

Rewritable optical

- applications: near-line storage of secondary access images; high-speed transport medium between vendor and institution
- advantages: ISO10089A and ISO13549 standards (supported by 10 manufacturers) for 5.25-inch and 3.5-inch MO technology; lower per/MB cost than magnetic disk
- disadvantages: two-sided discs must often by turned over to access data on each side; mid-term media life (30 years); less secure than WORM, as information can be erased or overwritten

CD-ROM

- applications: long-term storage of digital masters; moderate-speed transport medium between vendor and institution; publication medium for distribution
- advantages: ISO 9660 standard permits universal writing and reading; stable media; low cost (for media and CD writer); relatively long media life; well suited for multimedia
- disadvantages: slow recording and reading speeds; low capacity

Note: In spring 1996, announcements heralded the next-generation storage media "DVD" (digital video disc) that may become the new world-wide standard for audio, video, and computer data storage. Projected costs for the CD-sized digital disc are $20, with storage capacity up to 17 GB.

Tape

- applications: backup of archival masters; low-speed transport medium between vendor and institution
- advantages: very low cost; high capacity and portability; wide variety of formats (DAT,8mm, 3480 cartridges); compatible with programs for automated backup; ANSI and ECMA published standards; approved archival medium (National Archives and Records Administration)
- disadvantages: sequential access to data; slowest access; media degradation (e.g., flaking and binder stress) in aged tape or when stored in poor environments.

Storage devices

Access to data might be provided via a hard drive or CD-ROM drive on a single PC, or in a networked environment. Because storage requirements for digital image projects can quickly exceed several gigabytes, devices with multiple drives will need to be used, especially when access demands are high and constant.

An evaluation of specific devices should consider issues of scalability and integration, as well as speed and price. The planned rate of growth for a digital imaging program can also be a factor. The cost per MB of a device will be extremely high if the device is chronically under-utilized. Storage costs are optimized for at or near full capacity. As with the media itself, purchasing devices should be based on planned growth rates and the inherent capabilities to scale the system.

Examples of storage devices include: *towers* (stacked drives, with all information on-line); *arrays* (stand-alone components with greater capacities than towers, providing both near-and on-line access); and *jukeboxes* (varying capacities, near-line access only).

General storage classifications

On-line: media is engaged in a drive and ready for access
- retrieval in seconds or sub-seconds
- advantages: speed, reliability
- example: hard drive(s)
- *project example:* Journal Storage (JSTOR), University of Michigan, et. al., access images mounted on magnetic disk system, http://index.umdl.umich.edu/jstor/(subscription access only)

Near-line: data is accessed mechanically and engaged in a drive
- retrieval in seconds (if disc is engaged) or minutes (if disc must be retrieved or multiple users have requested access to the same information)
- advantages: security, reliability
- examples: WORM, rewritable optical, and CD-ROM jukeboxes
- *project example:* Project Open Book, Yale University, access images mounted on optical jukebox, http://www.library.yale.edu/pres/probweb.html

Off-line: shelf storage, media must be retrieved by a person
- retrieval in minutes to hours
- advantages: security, reliability, low cost
- examples: PhotoCDs on shelf
- *project example:* Computerization Project for Archivo General de Indias, LAN access to images on optical media, retrieved manually.

4. Maintaining long-term access

Many articles and studies have called for the need to "refresh," or "migrate" digital materials across hardware/software configurations and subsequent generations of computer technology. The most recent of these is the RLG/CPA Task Force report, *Preserving Digital Information: Final Report and Recommendations*.

It provides the clearest articulation of issues associated with providing continuing access to digital information. The report distinguishes between refreshing and migration:

> *The purpose of migration is to preserve the integrity of digital objects and to retain the ability for clients to retrieve, display, and otherwise use them in the face of constantly changing technology. Migration includes refreshing as a means of digital preservation but differs from it in the sense that it is not always possible to make an exact digital copy or replica of a database or other information object as hardware and software change and still maintain the compatibility of the object with the new generation of technology.* (Task Force, *p. 6*)

This distinction is important as it focuses on using technology to maintain usability. It is easy to make exact bit-for-bit copies of digital information, but difficult to ensure the same functionality over time. To date, there are no agreed-upon processes or model institutional programs for migrating (or even refreshing) digital image collections. The Task Force report recommends some incremental steps for developing this capability. It calls for the creation of a national distributed infrastructure, such as a system of digital archives, to collect and preserve digital information resources. It urges cooperation among "interested stakeholders" in creating the components of this infrastructure, in developing standards and policies, and in addressing the legal and economic barriers to preserving digital information.

Internationally, Australian cultural organizations, including the major state and university research libraries, have developed a "Draft Statement of Principles on the Preservation of and Long-Term Access to Australian Digital Objects" which is accessible on-line via the National Preservation Office (http://www.gsfc.nasa.gov/nost/isoas/overview.html). This statement outlines seven basic principles associated with creating, preserving, and making accessible digital information. Of particular significance is the assumption that it is not necessary to save all digitized information, and that resources should be devoted to retaining and preserving digital materials "only for as long as they are judged to have continuing value and significance."

One of the work items of the International Council on archives Image Technology Committee is a study of migration strategies and alternatives for

long-term access to digital material. The study identifies four components of migration strategies – supporting archival requirements, adhering to digital information technology standards, maintaining appropriate environmental standards, and implementing rigorous copying policies and procedures – that archives should take into account when utilizing digital information technologies. The full report will be available in early 1997.

Preservation strategy for digital image technology

The following preservation strategy is based on the assumption that original source materials may not be retained and that the long-term value of digital collections should be defined by their intellectual content, not limited by technical decisions made at any point along the digitization chain.

A preservation program for digital image information begins well before considering issues associated with migration, as the following list of strategies suggests:

- capture at level of quality consonant with informational content of originals; quality control critical
- use system components that conform to non-proprietary standards and open systems architecture
- use image formats and lossless compression techniques that are standard or require a bridge
- create appropriate backup copies (machine-readable as well as human-readable when necessary) for disaster recovery
- maintain proper environmental storage conditions
- monitor media, recopying data as necessary
- migrate data and metadata across generations of technology
- anticipate and plan for future technological development

Disposition of originals post scanning

Although the Australian statement raises issues associated with appraisal of digital information and its long term retention, the economics of developing and maintaining digital collections over time may only prove to be viable by offsetting maintenance costs for managing physical collections. Digital conversion ispo facto raises questions about the disposition of the source documents themselves. Can digital images serve as adequate replacements and thus, by extension, come to represent the source documents? If so, under what conditions may/should the source documents themselves be destroyed?

A growing number of business and governmental archives are undertaking digital backfile conversion projects of materials with long-term retention

requirements. Whether digital images can effectively replace original sources and be economically justified on that basis may well be an open question, but an institutions should consider the possibility that at some point original source materials may eventually be disposed of after their intellectual contents have been reduced to binary digits.

Figure 4 presents a decision tree on issues that librarians and archivists must address in determining the disposition of original source documents. It presents these issues as a series of questions and suggests courses of action based on answers given.

Selection for Conversion

Increasingly archives are initiating imaging projects in order to meet real or perceived needs. All too often, however, the impulse is strong just to try out the technology. There is much to be said for learning through doing, but the utility of digital images is most likely ensured when the needs of the users are clearly defined, the attributes of the documents are known, and the technical infrastructure (for conversion, maintenance, and delivery of images) is appropriate to the needs of the project.

Consider the following in choosing material for digital conversion:

Digital collection development

- informational value of individual documents
- collective value of groups of documents
- distributed sources and multiple formats
- relevance to other on-line sources (both data and metadata)
- thematic unity/critical mass
- multi-institutional initiatives

Physical attributes

- physical dimensions
- level of detail
- single leaf or bound
- quality and condition of originals
- use and condition of intermediates (e.g., duplicate 35mm slide)
- reflective versus transparent media
- production process used (machine printed, hand produced, halftone composition)
- relationship of media (inks, pencil, crayon, watercolor, etc.) to support

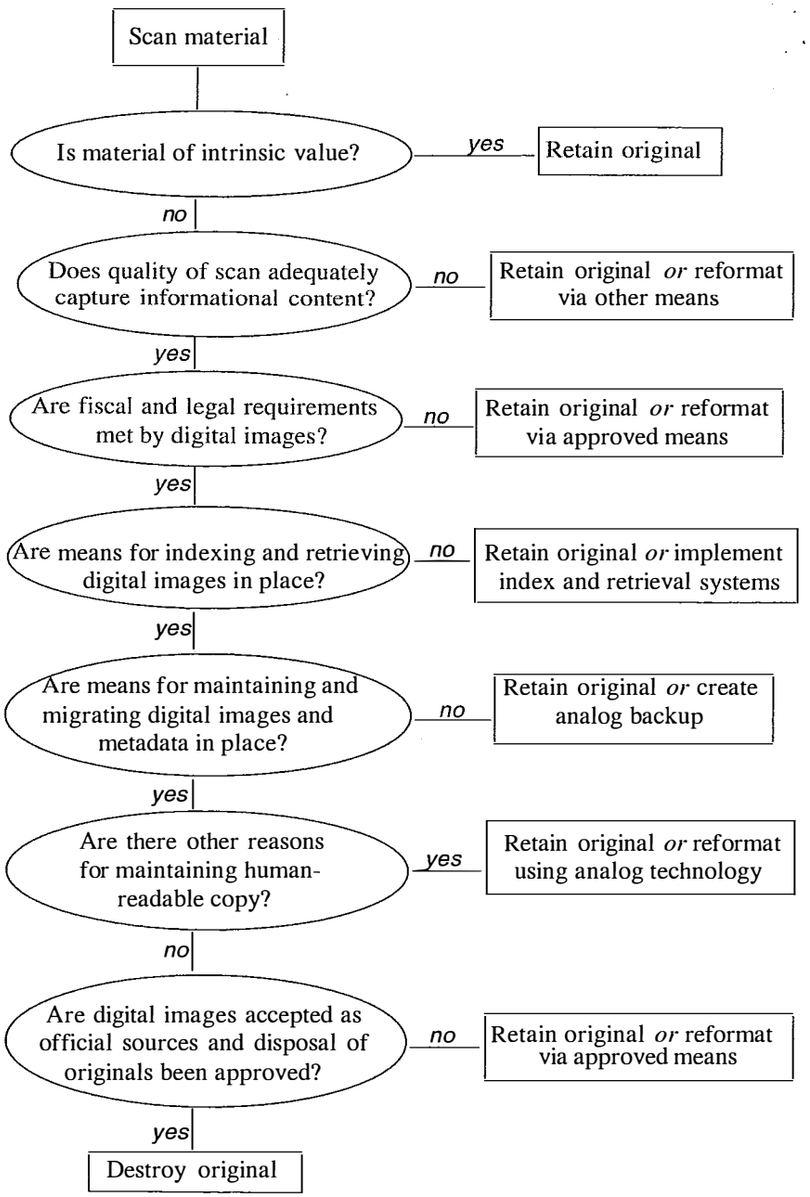


Figure 4. Disposition Flow Chart

(paper, color of paper)
- number of documents
- variety of document types and genres

Preservation considerations
- level of informational content that can be captured
- replacement/surrogate/reference use
- fidelity versus legibility
- quality benchmarks for reformatting (preservation microfilm or photocopy)
- disposition of the originals

Cost implications
- cost of image capture and indexing
- volume of material to be converted
- requisite technical infrastructure to support varied user needs
- institutional capability and commitment (e.g., archiving)
- cost effectiveness over time (e.g., spate savings)

Access
- level of arrangement/documentation/indexing
- frequency of use
- uses to which material will be put (on screen browsing, retrieval, reading, networking, printing, short term/long term)
- user requirements, perceptions, and technical capabilities
- security considerations
- legal restrictions

Where to begin?

In selecting material for an initial conversion project, consider a body of material that has high informational value, is cohesive, manageable, "doable," affordable, and not covered by copyright or other access restrictions. Choose material that is of high use or where there is anticipated high use (upcoming anniversaries, new courses, material currently inaccessible). Will the physical arrangement and level of bibliographic description available facilitate access to the digitized version? Consider the technological capabilities of your repository and of your primary clientele. If endangered material is digitized, the cost of access can in part be covered by the cost of preservation.

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GUIDELINES FOR MICROFILMING RECORDS OF ARCHIVAL VALUE

Gli Archivi nazionali canadesi hanno predisposto una guida tecnica ai programmi di fotoriproduzione di documenti con rilevante valore archivistico.

La guida illustra le diverse tappe della progettazione, le procedure, i requisiti tecnici, il controllo di qualità e le metodologie di conservazione.

La guida è corredata di un elenco degli standard canadesi, statunitensi ed ISO; segue un glossario terminologico ed esempi di schede e moduli per la rivelazione dei dati riguardanti il microfilm: descrizione, test di valutazione e di qualità, ispezione e certificazione del microfilm

Preface

The National Archives of Canada acquires, preserves and makes available records of national significance. The Archives also provides a comprehensive program that helps federal government institutions and ministers' offices manage their records.

The program includes advice on standards and practices for the management of information; management and protection of government information through a national network of records centres; and, finally, direction and assistance in planning the disposition of institutional records.

To ensure there is a consistent approach to information management within the government, the National Archives investigates the impact of emerging technologies, develops standards and practices, and produces technical handbooks.

Guidelines for Microfilming Records of Archival Value is one of a series of handbooks on records and information management.

The principal author is Susan Hall, who benefitted from the advice of experts in the image management field, particularly that of Wayne McCorrister. Any comments or questions about this handbook or about other information management issues are welcome. Please address your remarks to:

Director Information Management Standards and Practices Division
Archives and Government Records Branch
National Archives of Canada
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Ottawa, Ontario
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1. Introduction

This document provides guidance to government institutions on microfilming records of archival value to achieve archival film[1] and on the quality control and archival storage conditions necessary to achieve stable images and media permanence. These guidelines can also be adopted by organizations wishing to retain microfilm for lengthy periods of time.

Governrnent institutions should implement these provisions and processes when producing micrographic records in-house or when contracting for microfilm services from private sector service bureaux. Federal departments operating micrographic production offices should also refer to the National Standard of Canada CAN/CGSB-72.28-M88/BS 6660-1985 *Setting Up an~ Maintaining Micrographic Units*.

While this document provides guidance about common requirements, each microfilm application should be customized to suit its particular characteristics. The National Archives has a vested interest in preserving historical records of the Government of Canada and provides advice on developing micrographic applications in government institutions.

Government institutions using microfilm for records which may be required for evidential purposes should refer to the National Standard of Canada CAN/CGS-72.11-M93 *Microfilm and Electronic Images as Documentary Evidence* in addition to applying the microfilm system specifications in these guidelines. Institutions contracting for microfilm services from the private sector should apply the principles described in the National Standard of Canada CAN2-72.19-M85 *Criteria for the Evaluation of Micrographic Service Bureaux*.

These guidelines do not include specific procedures to microfilm books, bound material, or engineering and cartographic records. You may, however, contact the National Archives for advice on microfilming any type of record.

Similarly, these guidelines do not cover the use of diazo, vesicular, colour or computerized microfilm systems or discuss the construction or properies of various microfilm. This information is available in other publications and micrographic standards.

Guidelines for Microfilming Records of Archival Value focuses on micrographic applications created and maintained in roll film format. Many microfilm applications require constant updating and are often converted from roll form to a *unitized* microfilm *format* to simplify filming, filing and

[1] See Glossary terms, p. 174

film distribution or because of privacy requirements. Some examples of unitization include 16 mm and 35 mm microjackets for documents, aperture cards for maps, plans and drawings and updateable microfilm systems.

In a unitized system, information is updated or replaced on an on-going basis, and the film is regularly used and maintained in an office environment. Regular handling of the silver microfilm and its storage in an office environment shortens its overall *life expectancy*. However, a variety of options are available which should be assessed and implemented for each application. If you have, or are contemplating, a unitized microfilm system for archival records, contact the National Archives of Canada for advice.

Definitions, procedures and technical requirements in this guideline are based on National Standards of Canada (CAN), International Organization for Standardization (ISO), and the American National Standards Institute/Association for Information and Image Management (ANSI/AIIM) standards. A glossary of terminology is available in Appendix B.

2. General Requirements

The creation and long-term preservation of microfilm requires exact controls during film manufacturing, microfilming, film *processing* and film storage. Should any of the technical processes not meet minimum requirements or should proper storage conditions not be met, then the life expectancy of the microfilm is jeopardized.

For descriptions of the life expectancy of film not explained in this guideline, refer to ANSI IT9.11-1991 *Imaging Media–Processed Safety Photographic Film–Storage*.

Microfilm applications that capture records of archival value should meet the requirements below to ensure film life and guarantee the long-term preservation of the information. Details about each of these processes are explained in subsequent sections of these guidelines.

- Technical and procedural requirements for the specific micrographic application should be developed, documented and applied during microfilm production.
- *Silver-halide* polyester film is the preferred film for generating archival microfilm.
- Conventional *wet processing* is recognized by Canadian, international and American standards organizations as the most stable processing method to achieve microfilm permanence.

- All films (*camera microfilm, print master film* and *reference copies*) should be inspected to ensure image quality, stability and usability.
- The camera microfilm *(first-generation)* negative roll film should be stored under ideal storage conditions at all times.

The camera microfilm should be placed in proper environmental storage to ensure its preservation and to ensure the information is available and usable in the future. A negative or positive silver duplicate print *master film (second-generation microfilm)* should be made from the camera film to generate the required reference copies (third generation) for reference by users. Since the third-generation reference copy will be used as the working copy, its quality should faithfully reproduce all the record detail of the original documents.

3. Information needs analysis and systems planning

This section describes elements of systems planning crucial in developing technical specifications for the microfilm application. Other aspects of the systems development life-cycle are outside the scope of this guideline.

A complete information needs analysis and system design study should precede implementation of any micrographic application. Gather information about the program and activities to which the records belong, worlc flows, information uses, growth rate, etc., and completely assess and describe the documents (condition, age, colour, volume, security classification, etc.). These factors form the basis for the microfilm application and system specifications.

During the systems planning study, a decision on the retention and disposition of original or source documents should be made. When archival records are to be converted to microfilm, these archival microfilming guidelines should be employed. The *National Archives of Canada Act* requires government institutions to seek the consent of the National Archivist to destroy or otherwise dispose of records. This applies to both the original paper (source documents) and to microfilmed records.

Documentation resulting from information and systems planning should be recorded and maintained for the life of the microfilm application. Changes made to the application should also be documented and retained.

Procedures

To ensure continuity and legal acceptance of microfilming programs and

of individual microfilm applications, operating procedures should be developed to cover:

- initial testing
- document preparation
- microfilming
- processing
- inspection
- duplication
- storage
- disposition.

Generic requirements for each of these processes are explained in the remainder of this guideline.

4. Initial testing

Initial testing is done to obtain information and make decisions on the final technical microfilm specifications necessary for the particular record collection. It involves several processes.

First, analyze the information gathered during information and systems planning. Then, select a random sample of files and documents representing the various document characteristics (stapled, bound, old, two-sided, ink used, etc.) for microfilm testing. Process the sample through the operating procedures and document the test results.

Base the microfilm system specifications on the quality requirements of the reference generation (third-generation) microfilm. The camera microfilm (first-generation) should be produced to achieve the quality necessary to read and use the third-generation microfilm.

Next, process or *develop* the film and test for image *resolution, density,* legibility, *reduction ratio* and *exposure* latitude. Make the necessary duplicates, test image resolution and density, view the film and make a paper print.

From this process, technical specifications can be developed to implement the microfilm application. These specifications should include:

- type and size of film
- filming reduction ratios
- density requirements for the first-generation print master film and reference microfilm
- resolution requirements for the first-generation print master film and reference microfilm.

Keep a record of all tests and test results. Also, document conclusions and decisions taken about the microfilm application.

5. Document Preparation

Document preparation is done to ensure documents are in the proper files and sequence and in a condition that will permit orderly and accurate microfilming. Determine document preparation requirements in advance and document procedures as part of information and systems planning.

Microfilm records should be an accurate representation of the original or source records. To prepare documents for microfilming, first examine the records collection to ensure all files are in the correct order established by the record identification or classification system.

Identify rnisplaced files, folders or other file units and, as these are located, place them in correct sequence. Verify file content to ensure all documents to be microfilmed are in the file. To ensure the microfilm represents the complete record, make every effort to obtain missing items. If missing items cannot be found, insert a "missing" target (file, document or folder) in the correct place in the record collection.

Document size or physical form may prevent certain items from being microfilmed (e.g., exhibits in legal files, folded diagrams, artifacts). If this is the case, there are several acceptable approaches. Create a microfilm target to identify each item, explaining its omission and location, or take a picture of the item and microfilm the photograph or microfilm the item using two or more frames of film. For the latter, a target or sign is normally used to indicate multiple images. Place targets in the appropriate sequence during document preparation. While photographs should be placed in the proper sequence, operational constraints may require they be spliced to the appropriate roll of microfilm later.

As document preparation proceeds, cull the collection by removing copies and documents not to be included in the microfilm application as described in the information and systems planning specifications. Examine individual documents for imperfections and carefully remove staples, paper clips and other document fasteners.

Document Quality

A damaged document should be placed in a clear, non-glare plastic folder or sleeve or pieced together on the camera flatbed during microfilming. Never tape or glue a torn document and do not remove adhesive tape. These repair methods can destroy underlying inforrnation or cause further damage to the document.

If a page is so mutilated that some information is lost, back it with black paper. Backing paper should be at least the size of the document being backed. When necessary, use white backing on documents that could cause print *bleed through* (e.g., onion-skin paper). This procedure increases the contrast and provides a clearer image on film. Do not attempt to remove stains.

Microfilming poor quality documents often results in microimages that lack clarity and detail. If documents are so severely damaged that an acceptable image is not guaranteed, prepare and insert a notice explaining that the problem in image legibility lies with the quality of the original document and not with the quality of the microfilm.

Certain photographic methods may improve the legibility of the documents. Selective use of colour filters can reduce discolouration, increase contrast and improve reproduction of some colours. Only photographic methods should be used to enhance information (writing, printing, seals, etc.) found in legal or historical documents. Procedures for enhancing source documents are referenced in CAN/CGSB-72.11-M93 *Microfilm and Electronic Images as Documentary Evidence.*

Targets

A variety of targets are normally necessary to provide quick information retrieval, or they are specified by the operating procedures or the information and systems planning study. Some targets are inserted during document preparation, others during microfilming.

The microfilrn information and systems planning specifications identify which *eye-legible* images to prepare and insert during document preparation. These normally describe the records, such as the start or end of file, volumes or pockets, significant documents, or they can comprise other targets (bibliographic and/or biographic information or standard forms) needed for the microfilming application. These could also include targets for corrections, quality of originals, enhancements performed and missing documents. Targets used during microfilming are explained in section 6.

Indexing

There are many approaches to indexing and information classification. Each organization should select a system which best suits its need. Often the index is already available as a part of the record collection. If this is the case, it can be microfilmed and made available with the microfilm. If an index to the record collection does not exist, create one during document preparation.

Indexes provide a complete inventory of the information microfilmed and permit quick access to the records by users and researchers. During filming, verify the microfilm against the index to confirm complete capture of the record collection and, after inspection, identify file number or titles on the film storage containers. Maintain the index in hard copy or electronic form and, if possible, on the roll microfilm for the life of the microfilm application.

6. Microfilming

Microfilm specifications are highly dependent on the documents being filmed, the equipment being used and the requirements specified in the information and systems planning study.

Cameras

Planetary cameras offer maximum flexibility in *image arrangement* (format), reduction ratios and *exposure settings* and are traditionally preferred for microfilming archival records that are old and in poor condition.

Technological advances in *rotary cameras* have made them more useful than they were previously. Standardization of paper size and composition and of ink colours and the introduction of forms to record information are added reasons to use rotary cameras. However, very old, brittle or damaged collections or collections with a mix of document characteristics (size, colour, weight) are not normally microfilmed using a rotary camera.

Before microfilming, inspect and *calibrate* cameras according to the manufacturer's specifications and unique requirements and decisions made during the initial testing phase. Inspect the lens and other camera parts (counters, exposure controls, lights, etc.) daily to ensure the equipment is operating and calibrated properly. As a furtherprecaution, clean and check working parts when changing rolls of film. To ensure an acceptable quality of output, conduct resolution tests using standard processed film strips.

Install dividers between cameras to stop stray light which may affect exposure. Use a voltage stabilizer to maintai n constant illumination during microfilming and duplication. Keep the area free from dust, food, smoke and other contaminants and restrict the camera area from general admittance and use.

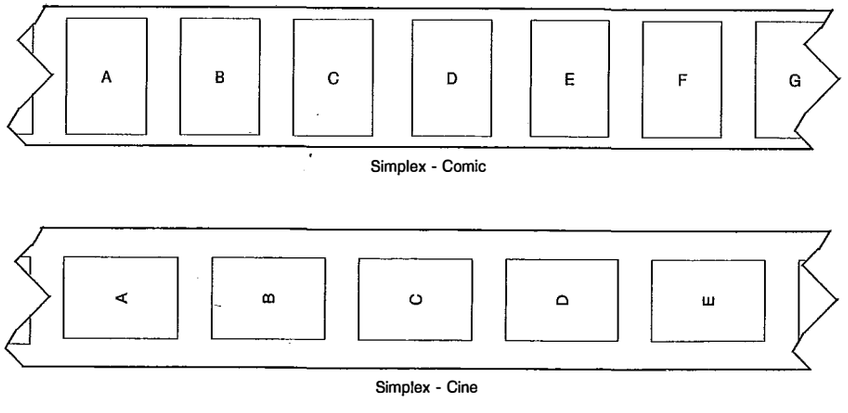
Microfilming Reports

Microfilming reports should be maintained and updated to control microfilm job numbers, film roll number and the number of exposures on the roll. A description of the records microfiImed (subject, file range, client, security, etc.), the date of filming, the date of processing and testing, and the operator's name should aIso be recorded Microfilming reports should be retained for the life of the micrographic application. Other microfilming reports required during film production are explained in subsequent sections of this guideline. See Appendix C for a sample Microfilming Report.

Microfilming Format

Microfilming format refers to the arrangement of document images on the microfilm. A *simplex format* for microfilming is recommended for archival records. This means that the film is run through the camera once, and a singIe row of images is photographed. This format accornmodates documents of various widths and lengths and offers the best versatility in information retrieval. The *horizontal mode (comic mode)* of *image orientation,* where information is read in sequence from left to right, is preferable to the *vertical mode (cine mode),* where information is read along the length of the film (see graphic).

Image formats on roll microfilm



Loading Film and Testing

Load the first-generation silver-gelatin microfilm into the camera under subdued lighting conditions. *Darkroom loading* is preferred. Silver-halide polyester AHU *(antihalation undercoating)* rnicrofilrn is recommended. The film leader and trailer should be a minimum of two to three feet (60 to 90 cm) long to avoid fogging from light during loading, to provide a methylene-blue test area and to allow for reader/duplicator threading.

Targets

All microfilm applications require the use of targets. The following paragraphs describe targets needed to microfilm records of archival value.

Start and end-of-roll targets provide an eye-legible image indicating where filming begins and ends.

Roll identifiers describe basic information about the records contained on the roll. This can include information about the department and subordinate organizational unit(s); project/record name, security classification and other identifying information about the record collection; the date filmed; the first file filmed (at beginning of roll); camera make/model; technical targets describing the microfilm specifications and other information such as roll number and the camera operator's name.

Certificates of authorization/authenticity indicate that microfilming has been performed during the regular and ordinary course of business, thereby lending credibility to the microfilming program. The certificate of authenticity should include the name of the camera operator, date of microfilming and authorizing signature. See Appendix C for sample Microfilm Certification Forms.

Resolution/Density Targets are used to measure image resolution and density. Use the Applied Image Incorporated[2]. MT-2 target or equivalent. The MT-2 target comprises an ISO No. 2 *resolution test chart* in the centre and four corners of the filming area, a 90 percent *reflectance target* and various sizes and styles of fonts.

Resolution and density targets are microfilmed to evaluate the photographic system. Film the resolution and density targets at the film reduction ratio chosen for the application. Always indicate the reduction ratio

[2] The MT-2 target is available from Applied Image Inc., 1653 East Main Street, Rochester, New York, 14609, telephone: (716) 482-0300.

on the microfilming report and at the start and end of each roll of film. See section 8.–Inspection and Appendix C– Forms.

All targets should be bilingual and oriented in the same direction as the documents to which they relate. Targets should also be kept clean and spotless at all times.

Film Sequence

Filming should take place in the following sequence:

- Ieader (length is dependent on camera manufacturer's specifications)
- methylene-blue test area (30-37.5 cm or 12-15 inches)
- space (15-20 cm or 6-8 inches)
- start-of-roll target
- space
- MT-2 target or equivalent
- space
- roll identifying information (roll number, reduction ration, job number, etc.)
- space
- certificate of authorization/authenticity
- space
- file cover or start-of-file target
- film documents (insert any indexing aids or spaces as determined and documented in the information and systems planning study)
- end-of-file target
- space
- roll identifying information
- space
- MT-2 target or equivalent
- end-of-roll target.

Film the end-of-roll target with sufficient film remaining to unload without causing unwanted fogging of the documents. The amount of unexposed film should comply with the manufacturer's specifications (normally 2 to 3 feet or 60 to 90 cm). After filming, send the exposed film for processing.

Filming the Documents

Documents should be filmed flat to avoid losing information to shadows

or creases. Where necessary, use glass plates (or clear plexiglass for safety) to achieve desired results. The entire document should be displayed on the photographic *field* of the planetary camera. Sometimes multiple images may be required because of oversized documents. If, for instance, three irnages were required, the camera operator would place a sign 1 of/de 3, 2 of /de 3, 3 of/de 3 on the photographic area.

If the application is automated or to be automated, the photographic field should provide sufficient area for a *document mark* or *blip encoding*. A blip can be mounted on the planetary board, below the document. Refer to ANSI/AIIM MS-8-1988 *Image Mark (Blip) Used in Image Mark Retrieval Systems.*

The integrity of the original records and the order of the record collection should be maintained during microfilming. Microimages of the records should be arranged, identified and indexed so that any individual document or component of the records can be located easily at any time during microfilm production.

It may be useful to prepare a sign or header with the appropriate file name or number to be microfikned in each frame. The cover of the file folder can be microfilmed, but the resulting image qualit,v may suffer due to the colour of the folder. Other applications may require bibliographic or biographic targets as specified during the systems design study.

7. Processing

The **latent image** microfilmed on the first-generation silver film is developed by conventional wet processing using a microfilm processor. Specific technical requirements on processing can be referenced in ANSI/AIIM MS23-1991 *Practice for Operational Procedures/Inspection and Quality Control of First-Generation, Silver Microfilm of Documents*.

Conventional wet processing involves the following basic steps:

- film development, which causes the exposed image to appear;
- stop bath or rinse, which arrests development, prevents stains and helps preserve the life of the fixing bath;
- fixing, which removes all undeveloped silver halide from the film *emulsion layer;*
- washing, which removes residual chemicals from the film; and
- drying, which removes moisture from the film. Drying needs to be carefully controlled to ensure the film is neither damp nor brittle.

Operate and maintain the microfilm processor according to the manufacturer's specifications to obtain the *chemistry control,* temperature and water flow necessary to achieve stable microfilm. Chemicals used in the processing system should be compatible with the specific type of microfilm and the processor. Use processing control strips to monitor equipment performance regularly.

8. Inspection

After processing, a qualified technician should inspect the microfilm to ensure technical specifications are being met. Film inspection should occur as soon as possible after film processing and conform with procedures established by national standards. Use an Inspection Report Form (see Appendix C) to record the results of the inspection and the film's adherence to the pre-determined specifications.

Film inspection is accomplished by measuring resolution and density, by conducting a residual thiosulphate ion (methylene-blue) test and by inspecting the film to determine image legibility. Microfilming processes should comply with or exceed requirements stated in national standards for microfilm and, in quality control and assurance, with ANSI/AIIM MS23-1991 *Practice for Operational Procedures/Inspection and Quality Control of Firsf-Generation, Silver Microfilm of Documents.* Maintain testing procedures and inspection results for the life of the application. Refer to Appendix C–Format Check (Quality Assurance Report.)

Conduct inspections in minimum ambient light. Avoid overhead fluorescent lighting. Visually inspect the film using a hand-held photographic measuring magnifier ~6 to 15X loupe) and a *light box* (tungsten specular light source) while advancing the film on rewinds. Slowly advance the roll of film over the light box to observe the images. About every 3 meters (10 feet), examine the filrn carefully for defects according to standard test criteria in ANSI/AIIM MS23-1991 *Practice for Operational Procedures/Inspection and Quality Control of First-Generation, Silver Microfilm of Documents.*

Maintain all inspection equipment *(densitometer,* microscope, light table, rewinds) used to evaluate the quality of the film in good operating condition according to the manufacturer's specifications. Clean, inspect and calibrate the equipment regularly according to operating instructions.

Handling

The camera microfilm and the second-generation microfilm can be damaged through improper handling. Wear clean, lint-free white gloves to handle silver microfilm. Load and unload film from equipment with care. Film

that has been scratched or otherwise damaged is more susceptible to deterioration later. Do not leave silver film' exposed to overhead lighting or direct sunlight because they fade the image.

Resolution

Resolution is defined as the ability of a photographic system to record fine detail distinctly. This is also expressed as *resolving power:* a numeric expression of the ability of a photographic system to distinguish or separate two closely spaced lines.

A quality, 100X magnification microscope and the filmed image of ISO Test Chart No. 2 are used to measure image resolution. Determine the smallest resolution pattern resolved on the test chart as described in ISO 3334-1989 *Microcopying–ISO Test Chart No. 2–Description and Use in Photographic Documentary Reproduction* (ANSI/AIIM MS51).

The determination of the minimum resolution target to be resolved should be in accordance with ANSI/AIIM MS23-1991 *Practice for Operational Procedures/Inspection and Quality Control of First-Generation, Silver Microfilm of Documents*. A deviation of more than one pattern below the specified pattern to be resolved is considered a major defect. See Appendix C for a sample ANSI and ISO Test Chart No. 2.

Density

Density is defined as the light-absorbing or light-reflecting characteristics of a photographic image (i.e., how dark the filmed images are). Control of density and contrast is most important to achieve high quality film.

A densitometer is used to measure background and image density. It should be a transmission type, designed to measure visual *diffuse transmission density* according to ANSI photographic standards. The densitometer should be capable of reliably measuring, within specified tolerances, densities on a control calibrated step tablet during set-up. Protect the densitometer and tablet from dirt, fingerprints and scratches.

The density of imaged documents on a microfilm roll will vary depending on the type, age and condition of the original documents. Some poor-quality, low-contrast documents may require a density range of 0.70 to 0.85, while high quality high-contrast printed documents could be filmed at 1.30 to 1.50. The maximum allowable difference between highest and lowest density across a

document of even background or between different documents of identical background should be 0.08 on the *density scale*.

Measure the background density of document images with a densitometer in three areas that are free of information. The *emulsion side* should be facing up or down according to the densitometer manufacturer's instructions.

ANSI/AIIM MS23-1991 *Practice for Operational Procedures /Inspection and Quality Control of First-Generation, Silver Microfilm of Documents* provides examples of the most commonly encountered microfilming defects and explains possible causes. Report microfilrn defects and deviation from specifications and take necessary corrective action. Note a probable cause of the defect on the Inspection Report Form and identify affected documents on the Refilming Log Form (see Appendix C) following procedures specified in ANSI/AIIM MS23-1991 *Practice for Operational Procedures/Inspection and Quality Control of First-Generation, Silver Microfilm of Documents*.

Splicing

Mistakes or omissions may occur duIing filming that will require refilming and subsequent splicing of corrections or amendments to the camera microfilm (first-generation). Always splice corrections in the proper sequence to achieve greater file integrity. Remember to film only at the beginning of the roll should the information be needed for documentary evidence. No more than three splices ~six cuts) per roll of film should be accepted. *Ultrasonic splicing* is preferred. Tape, glue and heat splicing are not recommended for archival film.

The correct splicing procedure is to refilm the two images or frames before the correction, the correction itself and the two images following the correction. There should not be any splices between the technical targets and the first or last 10 images on a roll.

Methylene-Blue Testing

The amount of residual thiosulphate (fixer) remaining on the microfilm after washing is determined by methylene-blue testing on a clear portion of processed film. The test is to be completed within two weeks of processing and according to processes identified in ANSI IT9.1-1989 *Imaging Media (Film)–Silver-Gelatin Type– Specifications for Stability*. The test should be performed on every batch of film processed, when film type is changed or when processing

chemicals are replenished.

The maximum level of residual thiosulphate is 1.4 micrograms per square centimetre as per ANSI IT9.1-1989 *Imaging Media (Film)–Silver-Gelatin Type–Specifications for Stability*. Report results of methylene-blue testing immediately and certainly no later than 48 hours after testing. Residual thiosulphate test materials, instruments,' glassware, reagents and methods of measurement are described in ANSI PH4.8-1985 *Determination Measurement of Residual Thiosulphate and Other Chemicals in Films, Plates and Papers*.

Verification

After microfilming, processing and technical inspection, verify the microfilm for completeness of informa _ A, retrievability and legibility. This can vary from a quick scan of the index to verify if it is the correct material or visual scanning of the film at 10-foot intervals, to a page-by-page comparison with the original document to ensure complete capture of the information in its proper sequence. Identify and document these requirements during the information and systems planning study. Locate, refilm and splice, in their correct position, documents that requir refilming.

9. Duplication

Each successive generation of microfilm loses resolution or image clarity, which may cause legibility problems. However, with good quality-control practices during microfilming and processing, duplicates should be of acceptable quality.

Direct duplicating film (silver halide) is recommended to create a printing master. Reference or duplicate copies can be created from silver, diazo or vesicular film. The type of duplicate will depend on the quality and polarity requirements of the reference copy as determined in the information and systems planning study.

10. Storage

First-generation silver microfilm should be placed in environmental storage to ensure its preservation and to guarantee that images will remain stable. Environmental storage is necessary to retain the archival properties achieved during microfikning and processing and validated by film inspection.

Store the microfilm using storage conditions specified in ANSI IT9.11-1991 *Imaging Media–Processed Safety Photographic Film–Storage*. Government institutions can store their original silver microfilm with the National Archives of Canada which maintains an environmentally stable microfilm storage vault.

Silver microfilm should be stored at a maximum temperature of 18°C and at a relative humidity of 25 percent. Roll microfilm reels and containers should be constructed of inert and non-corrosive materials. Non-ferrous metals such as anodized aluminum or stainless steel are acceptable. Stable inert plastics that are free of peroxides can also be used. Moisture-resistant tape should be used to seal containers. Contaminants can damage microfilm stored in untaped cans.

Only industry-approved conservation materials (paper, glues, labels or other adhesives) should be used to store the microfilm. The microfilm containers should be stored in inert metal cabinets that have been treated with non-corrosive, non-staining and non-combustible paint. Wooden cabinets should not be used to store film.

Specifications for microfilm storage facilities and containers, and for handling and inspecting stored film, are described in ANSI IT9.11-1991 *Imaging Media–Processed safety Photographic Film–Storage*. Regular inspection of stored microfilm is strongly recommended to ensure it is not being adversely affected. Refer to specifications in ANSI/AIIM MS45-1990 *Recommended Practice for Inspection of Stored Silver-Gelatin Microforms for Evidence of Deterioration.*

11. Disposition

Disposition is the process that determines what happens to records which are no longer needed by government institutions In the Government of Canada, the disposition of records of government institutions and ministerial records is guided by the *National Archives of Canada Act* (1987). This Act requires government institutions to do two things: (1) obtain the approval of the National Archivist before disposing of their records; and (2) transfer the records that, in the opinion of the National Archivist, are of historic or archival importance to the National Archives.

The National Archives coordinates these two activities with each government institution through the development ' ~. of disposition plans and *Records Disposition Authorities*. Information and records management staff should ensure that their institution's microfilmed and source records are included in disposition plans. This helps achieve the integrated disposition of governrnent information, in all media, that is related by program, function or activity.

To find whether an approved Records Disposition Authority exists for your records, contact the information management office in your department or agency. If you need more information concerning disposition and microfilming records, contact the National Archives.

SUSAN HALL
National Archives, Ottawa, Canada

APPENDIXES

A. STANDARDS

National Standards of Canada

The following is a list of Canadian microfilrn standards.

CAN2-72.7-M88
Manual Drafting Requirements for Drawings to Be Microfilmed
CAN/CGSB-72.11-M93
Microfilm and Electronic Images as Documentary Evidence
CAN2-72.15-M83
Computer Output Microfilm (COM) Microfiche
CAN2-72.16-M83
Computer Output Microfilm (COM) 16 mm Roll
CAN2-72.18-M85
Microfiche Enclosures
CAN2-72.19-M85
Criteria for the Evaluation of Micrographic Service Bureaux
CAN/CGSB-72.21-M89
Micrographics–Diazo and Vesicular Films–Visual Density–Specifications
CAN/CGSB-72.22-M87
Flowchart Symbols and Their Use in Microfilming
CAN/CGSB-72.28-M88/BS 6660-1985
Setfing Up and Maintaining Micrographic Units.

Canadian General standards board provisional standards

Provisional standards are documents that have been published without passing through all the procedures required for CGSB standards or National Standards of Canada. They may be issued if there is a clear and urgent; need for a published standard and when time does not permit all the steps required to issue an approved standard.

The provisional standards that existed at the time of publication were as follows:

CAN 72-GP-17P
Performance of Readers
CAN 72-GP-23P
Graphical Symbols for Use in Microfilming
CAN 72-GP-lOOP
Proviszonai Glossary of Micrographic Terms.

International organization for standardization

For a complete list of international standards for microfilm, refer to AIIM Resource Report–Imaging Standards, 1991 by Marilyn Courtot.

ISO 3334-1989
Microcopying–ISO Test Chart No. 2–Description and Use in Photographic Documentary Reproduction (ANSI/AIIM MS51).

American National standards institute and the association for information and image management standards

The following is a list of ANSI and ANSI/AIIM standards referenced in this guideline For a complete list of ANSI/AIIM standards refer to AIIM *Resource Report–Imaging Standards, 1991 by MariIyn Courtot.*

ANSI/AIIM MS-8-1988
Image Mark (Blip) Used in Image Mark Retrieval Systems
ANSI/AIIM MS23-1991
Practicefor Operational Procedures/Inspection and Quality Control of First-Generation, Silver Microfilm of Documents
ANSI/AIIM MS45-1990
Recommended Practice for Inspection of Stored Silver-Gelatin Microforms for Evidence of Deterioration
ANSI IT9.1-1989
Imaging Media (Film)–Silver-Gelatin Type–Specifications for Stability
ANSI IT9.11-1991
Imaging Media–Processed Safety P1~otographic Film–Storage
ANSI PH4.8-1985
Determination and Measurement of Resid1lal Thiosulphate and Other Chemicals in Films, Plates and Papers

B. Glossary

Unless otherwise indicated, glossary definitions are based on definitions in CAN 72-GP-l00P *Provisional Glossary of Micrographic Terms.* For definitions not found in this glossary, refer to CAN 72-GP-100.

Antihalation
The reduction of halation (light scattering or reflection) within a film. Four common methods are used to reduce halation: 1. Tint the film base with a light-absorbing dye. 2. Coat the back of the film with a light-absorbing material. 3. Introduce a layer of light-absorbing dye between the base and the emulsion. See also "antihalation undercoat." 4. Tint the emulsion layer.

Antihalation Undercoat
A separate layer of light-absorbing dye placed between the emulsion and the base to suppress light scattering or reflection. During processing of this film, the dye layer becomes transparent.

Archival Film
A photographic film, suitable for preserving records having permanent value, achieved when the film is properly microfilmed, processed, inspected and stored under archival storage conditions, provided that original images are of suitable quality. See also "archival quality" and "archival storage conditions."

Archival Master
An archival master is a copy held by the National Archives that has been designated as the record that most closely approximates either the original record or the creator's original intent.
While archival masters may have the same preservation priority as original records, they always have a higher priority than conservation and reference copies.

Archival Quality
The ability of a processed print or film to permanently retain its ori~inal characteristics. The ability to resist deterioration.

Archival Storage Conditions
Conditions suitable for preserving photographic film having permanent historical value. Archival storage conditions will prolong the useful life of both archival and non-archival films[3].

Bleed Through
The undesired appearance of information from the back of a document when its front is photographed.

Blip Encoding
See "Retrieval Mark."

Calibrate
To determine the relationship between measured values for any apparatus. See also "Step Tablet".

Camera Microfilm
First-generation microfilm, frequently called master film.

Chemistry Control
The process of replenishing chemical in the microfilm processor, which involves using control strips to determine when chemical agents need to be replenished[4].

Cine Mode
See "Vertical Mode."

Comic Mode
See "Horizontal Mode."

Contact Printing
A method of copying in which raw stock is held in contact with film bearing the image to be copied. Se also "Diffuse Transmission Density."

Contrast
An expression of the relationship between the high and low brightness of a subject or between the high and low density of a photographic image.

Control Strips
Strips of a stable film exposed to a photographic step wedge under rigidly controlled sensitometric conditions. They are processed and evaluated to

[3] ANSI IT9.1-1989 *Imaging Media (Film) – Silver-Gelatin Type – Specifications for Stability.*
[4] National Archives of Canada definition.

measure normality of a process, material or technique. Synonymous with "sensitometric strips."

Darkroom Loading
The requirement, capability or act of placing light-sensitive material in a camera, cassette, etc. under safelight conditions to prevent unwanted exposure of light-sensitive material.

Densitometer
A device used to measure the optical density of an image or base by measuring the amount of incident radiant energy (light) reflected or transmitted.

Density
Light-absorbing or light-reflecting characteristics of a photographic image, filter, etc.

Density Scale
A measure of the density range of a photographic image obtained by subtracting the minimum density from the maximum density.

Develop
To subject to the action of chemical agents or physical agents (as in electrophotography) to bring to view the invisible or latent image produced by the action of radiant energy on a sensitized surface.

Diffuse Transmission Density
A measure of density that simulates contact printing. It is obtained when the incident radiant energy (light) is perpendicular to the plane of the sample and all the transmitted radiant energy is collected and evaluated. It provides the same density value as a projection density measurement, when the film consists of a non-scattering material, e.g., diazo. See also "Contact Printing."

Diffusion
The scattering of light rays which cause light falling on a surface or passing through an aperture to come from all directions, in contrast to the radiation of light from a point source. Diffusions may be introduced by reflection from a matte surface, transrnission through a frosted or opal glass or

[4] National Archives of Canada definition.

use of an integrating bar. When diffusion is complete, a sharp image of the light source can no longer be formed.

Direct Duplicating Film
See "Direct-Image Film."

Direct-Image Film
A film that will retain the same polarity as the previous generation or the original material; that is, tone for tone, black for black, white for white, negative for negative or positive for positive with conventional processing. See also "Polarity."

Document Mark
An optical mark on a roll of microfilm used for counting images or frames automatically. It is usually rectangular and within the recording area below or above the image or both.

Duplicate
A copy of a microfilm made by contact printing or optical means.

Emulsion
A single or multilayer coating of light-sensitive materials in a thin layer on a film base.

Emulsion Layer
The layer containing image-forming, light-senslbve substances or photoconductors in a photographic

Emulsion Side
The side of a photographic fikn, plate or paper on which the emulsion is coated. In silver film, it is typically the dull side; the converse of base side.

Exposure
1. The act of exposing a sensitive material to radiant energy. 2. The time during which a sensitized material is subjected to the action of radiation. 3. The product of radiation intensity, and the time during which it acts on the photosensitive material.

Exposure Latitude
Permissible change in camera exposure without significant effect on

image quality. The change is affected by the definition of image quality, the usable extent of the sensitometric curve and the subject lumina range (contrast).

Exposure Settings
The camera shutter speed or light level used to control the quantity of light or radiant energy received by photosensitive material.

Eye-Legible Images
Images readable without magnification.

Field
The area covered or "seen" by the optical system of a camera.

First Generation
See "Camera Microfilm."

Format
See "Image Arrangement" and "Image Orientation."

Generation
One of the successive stages of photographic reproduction of the camera microfilm (original first-generation microfilm). Copies made from this first generation are second generation, etc.

Horizontal Mode
A method of recording images on roll microfilm in which lines of print or writing are parallel to the length of the film for horizontal script and perpendicular for vertical script.

Image Arrangement
The placement of microimages within a given microform. See also "duo," "duo-duplex," "duplex," "multiplex" and "simplex"[5].

Image Orientation
The arrangement of images with respect to the edges of the film. See also "Horizontal Mode" and "Vertical Mode."

[5] Only simplex format is defined for this document. Refer to CAN 72-GP100P *Provisional Glossary of Micrographic Terms* for the definition of "duo-duplex", "duplex" and "multiplex".

Latent Image
The invisible image produced by the action of radiant energy on a photosensitive material. It may be made visible by the process of development.

Leader
1. The length of film at the beginning of a roll used for protection and for threading into equipment such as cameras, processors and readers. 2. An unused or blank length of magnetic tape at the beginning of a reel of tape. The leader precedes the text or the recorded data. See also "Trailer."

Life Expectancy
The length of time information is predicted to be retrievable in a system under extended-term storage conditions.[6]

Light Box
A device in the form of a box containing a translucent light-dispersing material that evenly illuminates the viewing area.

Long-Tenn Film
A photographic film suitable for preserving records for a minimum of 100 years when filmed, process inspected and stored under archival conditions, provided the original images are of suitable quality[7].

Master Film
Any film used to produce further reproductions, such as intermediates or distribution copies.

Medium-Term Film
A photographic film suitable for preserving records for a minimum of 10 years when stored unde medium-term conditions, provided the original images are of suitable quality[8].

Methylene Blue
A chemical dye formed during testing of archival permanence of processed microimages using the methylene-blue method.

[6] ANSI IT9.11-1991 *Imaging Media – Processed Safety Photographic Film – Storage.*
[7] ANSI IT9.1-1989 *Imaging Media (Film) – Silver-Gelatin Type – Specifications for Stability.*
[8] *Ibidem.*

Methylene-Blue Method
A method of chemically testing the archival permanence of processed microimages.

Planetary Camera
A type of microfilm camera in which the document being photographed and the film remain in a stationary position during exposure. The document is on a plane surface during filming. Also known as "flatbed camera."

Polarity
The change or retention of the dark-to-light relationship of an image, i.e., a first-generation negative second-generation positive indicates a polarity change, while a first-generation negative to a second-generation negative indicates the polarity is retained. See also "Direct-Image Film."

Processing
A series of steps for treating exposed photographic material to make the latent image visible and ultimately usable, e.g., developing fixing, washing and drying.

Quality Assurance
An assessment of all the quality control activities of a micrographic program to verify that all applicable technical standards and recommended industry practices are being followed and that overall control of the operations is being carried out effectively at all stages. It includes regular review of the micrographic program goals and objectives and a series of audits done periodically by an independent group or person[9].

Quality Control
Techniques and procedures designed to measure and maintain clarity of the photographic image and stability of the media in accordance with predetermined quality levels and applicable standards.

Reduction Ratio
The relationship (ratio) between the dimensions of the original camera microfilm or master and the corresponding dimensions of the microimages; e.g., reduction ratio is expressed at 1:24.

[9] National Archives of Canada definition.

Reflectance
The ratio of luminous flux reflected from a surface to the luminous flux incident on the surface. See also "Spectral Reflectance."

Reflectance Target
A test target with a known fixed reflectance.

Resolution
The ability of a photographic system to record fine detail. See also "Resolution Test chart," "Resolving Power" and "Spurious Resolution."

Resolution Test Chart
A chart with several increasingly smaller resolution test patterns. The pattern is a set of horizontal and vertical lines of specific size and spacing. ISO Test Chart No. 2 is generally used in micrographics.

Resolving Power
The numeric expression of the ability of an optical or photographic system to distinguish or separate two entities spaced closely together. In micrographics, it is the product of the number of the standard test patterns resolved m the image multiplied by the reduction and expressed in line pairs per millimetre.

Retrieval Mark
A line, blip or other mark recorded adjacent to the microimage and used for automatic retrieval on appropriate equipment.

Rewind
1. A support and a device consisting of a spindle geared to a crank used in pairs to wind film from one re~ to another. 2. The act of transferring film from one reel to another.

Rotary Camera
A type of microfilm camera that photographs documents while they are being moved by a transpor mechanism. The document-transport mechanism is connected to a film-transport mechanism, and the fik also moves during exposure so there is no difference in the rate of relative movement between the film an the image of the document.

Rotary Filming
A method of rnicrofilming in which the document and the microfilm are in

synchronized moveme exposure.

Second-Generation Microfilm
A microfilm copy made from the camera film.

Silver Halide
A compound of silver and one of the elements known as halogens: chlorine, brornine, iodine and fluori

Simplex Format
1. A method of recording images in which a single microimage occupies all or a major portion of the usable width of the microfilm. 2. Format on microfilm using the technique in 1. See also "Image Arrangement".

Source Document Microfilming
Conversion of documents, usually paper, to microimages.

Spectral Reflectance

The ratio of radiant flux in a narrow wavelength interval reflected from a surface to that incident on the surface. See also "Reflectance."

Splice
A joint made by cementing, taping or welding (heat splice) two pieces of film or paper together so they will function as a single piece when passing through a camera, processing machine, viewer or other apparatus. Cemented splices are called "lap splices" because one piece overlaps the other. Most welds are called splices" since the two pieces are butted together without any overlap.

Spurious Resolution
A false indication of resolving power that may be recognized by counting the number of lines in a pattern that appear to be resolved. See also "Resolution" and "Resolving Power."

Step Tablet
1. A length of film containing gradations of density, which may or may not be calibrated. (A calibratec step wedge is used as a standard in the calibration of a densitometer.) 2. A grey scale. A series of tones iI steps of regularly increasing known densities from white to black on a film base or glass plate

used for processing and printing control. Synonymous with "grey chart," "grey scale," "grey wedge," "modulator,' "photographic wedge" or "step wedge." See also "Calibrate."

Target
Any document or chart containing identification information, coding or test charts.

Technical Target
An aid to technical control that indicates the reduction and resolution of the film. See also "Target."

Trailer
The portion of film beyond the last images recorded. See also "Leader."

Ultrasonic Splicing
See "Splice."

Unitize
1. To separate a roll of microfilm into individual frames or groups of frames and insert them in a carrier, e.g., aperture cards, jackets. 2. To microfilm on one or more of the same type of microform, a unit of information such as a report, specification or periodical.

Vertical Mode
A method of recording images on roll microfilm in which lines of print or writing are perpendicular to the length of the film for horizontal script and parallel for vertical strips.

Wet Processing
Processing done using chemicals in liquid or vapour form. See also "processing."

C. Forms

MICROFILMING REPORT

Camera number _____ Photographer _____

Date	Film number	Title of record	Volume number	Years	Exposures	Work order number

MICROFILM INSPECTION REPORT

Code: X = Reject PX = Partial reject F = Fault not in image area

PROGRAM _____ INSPECTOR _____ DATE INSPECTION _____

TYPE: ☐ Silver ☐ Diazo ☐ Vesicular GENERATION: ☐ 1 Emulsion wound out ☐ 2 Emulsion wound in ☐ 3

Defect	Roll/fiche number						
1. Summary							
2. Leader							
3. Fogged start							
4. Targets							
a. Start							
b. Roll/fiche number							
c. Identification							
d. Date filmed							
e. Reduction ratio							
f. Certification							
g. Resolution							
h. Density							
i. End							
5. Fogged center							
6. Fogged end							
7. Density							
8. Base plus fog							
9. Resolution							
10. Process damage							
11. Splices							
12. Scratches							
13. Spacing							
14. Fingerprints							
15. Object in frame							
16. Skewing							
17. Foreign matter							
18. Contractions							
19. Centering							
20. Overlap							
21. Blips							
22.							
23.							
24.							

INSPECTION REPORT FORM

Roll number _____ Control number _____

Job _____

Camera number _____ Operator _____

Date _____

Physical Defects

Defect	Major	Minor	Comments
Film mottle			
Fingerprints			
Frilling			
Pressure marks			
Risidual dyeback			
Reticulation			
Scratches			
Water spots			
Other			

Photographic Defects

Defect	Major	Minor	Comments
Blank film			
Contraction			
Dark streaks			
Double exposed			
Edge fog			
Fog			
Folded documents			
Jam			
Light streaks			
Overdevelopment			
Overexposure			
Pressure marks			
Static marks			
Streches			
Synchronization			
Underdevelopment			
Underexposure			
Washboard			
Other			

FORMAT CHECK

Item Checked		Comments
Image orientation (IA, IIA)	☐	
Centering	☐	
Indexing coding	☐	
Image layout and sequence	☐	

Test	Requirements	Results
Reduction ratio		
Resolution or QI		
Background density		
D min		
Residual thiosulfate		
Practical test		
Other		

Comments _____

Inspector _____ Date _____

MICROFILM CERTIFICATION FORMS

1. Use of Microfilm Certificate Forms

These certificates are to be used when microfilming Covernment Records as identified in the Public Records Order (P.C. 1966-1749). Using these forms does not guarantee that the microfilm will be accepted as evidence. Well established and documented systems and procedures must also be in place as well as compliance with National Standards of Canada Number CAN 2-72.11–79.

(a) *Start - end* certificates are to appear immediately before and after the filming of the documents. (See Notes)

(b) *Retakes – Start. Retakes* - End certificates are to be used when it is found necessary to refilm document(s) and are to appear immediately before and after document(s) being refilmed.

(c) *Retake Storing Location:* The most effective storing location for all retakes on a roll film system is at the beginning of the concerned rolJ of microfilm.

(d) The certificates shall have a retention period equal to the documents being microfilmed.

2. Applicable Standards

National Standards of Canada Number CAN 2-72.11-79 "Microfilm as Documentary Evidence" is applicable and is to be used in conjunction with the "Microfilm Certificate" forms.

3. Completion of the Forms

(a) *Department* - shall be the

LES CERTIFICATS DE MICROFILM

1. Utilisation des certificats de microfilm

Ces certificats doivent etre remplis lors du microfilmage de dossiers de l'administration publique aux termes du decret sur les documents publics (CP. 1966- 1749). Ces formules ne garantissent pas qu'un microfilm sera admis en preuve. Des systèmes et procédures bien etablis et définis doivent aussi exister; en outre. il faut respecter la norme du Canada portant le numero CAN 2-72.11-79.

a) *Début-fin.* Ces certificats doivent paraître immédiatement avant le debut et après la fin des documents microfilmes. (Voir les notes)

b) *Reprises - debut, reprises - fin*. Ces certificats doivent etre utilisés lorsqu'il est nécessaire de reproduire un ou plusieurs documents; ils doivent paraitre immédiatement avant le début et après la fin du document reproduit.

c) Localisation des reprises: la meilleure façon de pouvoir localiser les reprises consiste a les inscrire au debut du rouleau de microfilm reproduit.

d) Les certificats doivent être conservés aussi longtemps que les documents microfilmés eux-mêmes.

2. Norme applicable

La norme du Canada portant le numero CAN 2-72.11–79, intitulée "Microfilm - Preuve litterale" s'applique à tous les microfilms certifiés.

3. Comment remplir les certificats

a) *Ministère* – le ministère est celui qui

department that owns or is in custody of the records being microfilmed .

(b) *Location* - Either the address of the department's head omce or the Regional Office in which the records are located may be used.

(c) *Date microfilmed* - shall indicate the date that the microfilming took place.

(d) *Camera operator* - shall be the original signature of the camera operator. This identifies the operator as an employee of the department or that he/she was authorized to do the microfilming.

(e) *Authorizing signature* – shall be the signature of the person who has been designated with the responsibility of the microfilm program in the department. (See Section 6 CAN 2-72.11–79.) The purpose of the signature is to identify the person with this responsibility at the time of microfilming.

Notes

(a) When more than one roll of microfilm is needed to complete a file. START and END certificates for that file may be re-used throughout the day but should be progressively identified as A1. A2. A3. etc. for the START certificate and B1. B2. B3. etc. for the END certificate. A new form however must be used for each day.

(b) Microfilm certificates may be filmed more than once in succession to ensure acceptability.

a) *Ministère* – le ministère est celui qui possède ou détient les dossiers microfilmés.

b) *Endroit* – soit l'adresse de l'administration centrale du Ministère soit celle du bureau régional où les dossiers sont conservés.

c) *Date de microfilmage* – date réelle de microfilmage des documents.

d) *Operateur de la camera* – l'opérateur de la caméra doit signer le certificat. L'opérateur de la camera doit etre un employé du Ministère ou une personne autorisée par celui-ci a faire les microfilms.

e) *Agent autorisé* – signature de la personne chargée du programme de microfilmage du Ministère. (Voir le paragraphe 6 de la norme CAN 2-72.11-79.) L'agent autorisé est la personne responsable du programme de microfilmage a la date ou les microfilms ont été faits.

Notes

a) Lorsqu'il faut utiliser plus d'une bobine de film pour microfilmer un dossier on peut utiliser un seul certificat de DEBUT et de FIN par jour, numéroté A1, A2, A3, etc. pour le certificat DEBUT et B1, B2, B3, etc. pour le certificat de FIN. Il faut cependant remplir un nouveau certificat chaque jour.

b) Les certificats de microfilm peuvent etre photographiés plus d'une fois, successivement. pour garantir la qualité de la microphotographie.

START DÉBUT

Government of Canada / Gouvernement du Canada

MICROFILM CERTIFICATE
CERTIFICAT DE MICROFILM

Department – Ministère

Location – Endroit

All document images which follow on this microfilm file are accurate reproductions of records belonging to the Department mentioned above, and were microfilmed in accordance with the established practice of the above Department respecting the maintenance and preservation of such records.

Toutes les images de documents que contient le présent dossier microfilmé constituent des reproductions exactes des documents du ministère susmentionné et ont été microfilmées conformément aux usages du ministère en ce qui a trait à leur entretien et à leur conservation.

Microfilming procedures are in compliance with the Department's policies and applicable standards.

Les méthodes de microfilmage suivies sont conformes aux politiques du ministère et aux normes applicables.

Date Microfilmed – Date du microfilmage

Camera Operator – Opérateur de la caméra

Authorized Signature – Agent autorisé

AEC-360 (83/7)

START DÉBUT

END FIN

Government of Canada / Gouvernement du Canada

MICROFILM CERTIFICATE
CERTIFICAT DE MICROFILM

Department – Ministère

Location – Endroit

All document images contained on this microfilm file, are accurate reproductions of records belonging to the Department mentioned above, and were microfilmed in accordance with the established practice of the above Department respecting the maintenance and preservation of such records.

Toutes les images de documents que contient le présent dossier microfilmé constituent des reproductions exactes des documents du ministère susmentionné et ont été microfilmées conformément aux usages du ministère en ce qui a trait à leur entretien et à leur conservation.

Microfilming procedures are in coinpliance with the Department's policies and applicable standards.

Les méthodes de microfilmage suivies sont conformes aux politiques du ministère et aux normes applicables.

Date Microfilmed – Date du microfilmage

Camera Operator – Opérateur de la caméra

Authorized Signature – Agent autorisé

END FIN

RETAKES REPRISES

Government of Canada / Gouvernement du Canada

MICROFILM CERTIFICATE
CERTIFICAT DE MICROFILM

Department – Ministère

Location – Endroit

All document images contained on this microfilm file, are accurate reproductions of records belonging to the Department mentioned above, and were microfilmed in accordance with the established practice of the above Department respecting the maintenance and preservation of such records.

Toutes les images de documents que contient le présent dossier microfilmé constituent des reproductions exactes des documents du ministère susmentionné et ont été microfilmées conformément aux usages du ministère en ce qui a trait à leur entretien et à leur conservation.

Microfilming procedures are in compliance with the Department's policies and applicable standards.

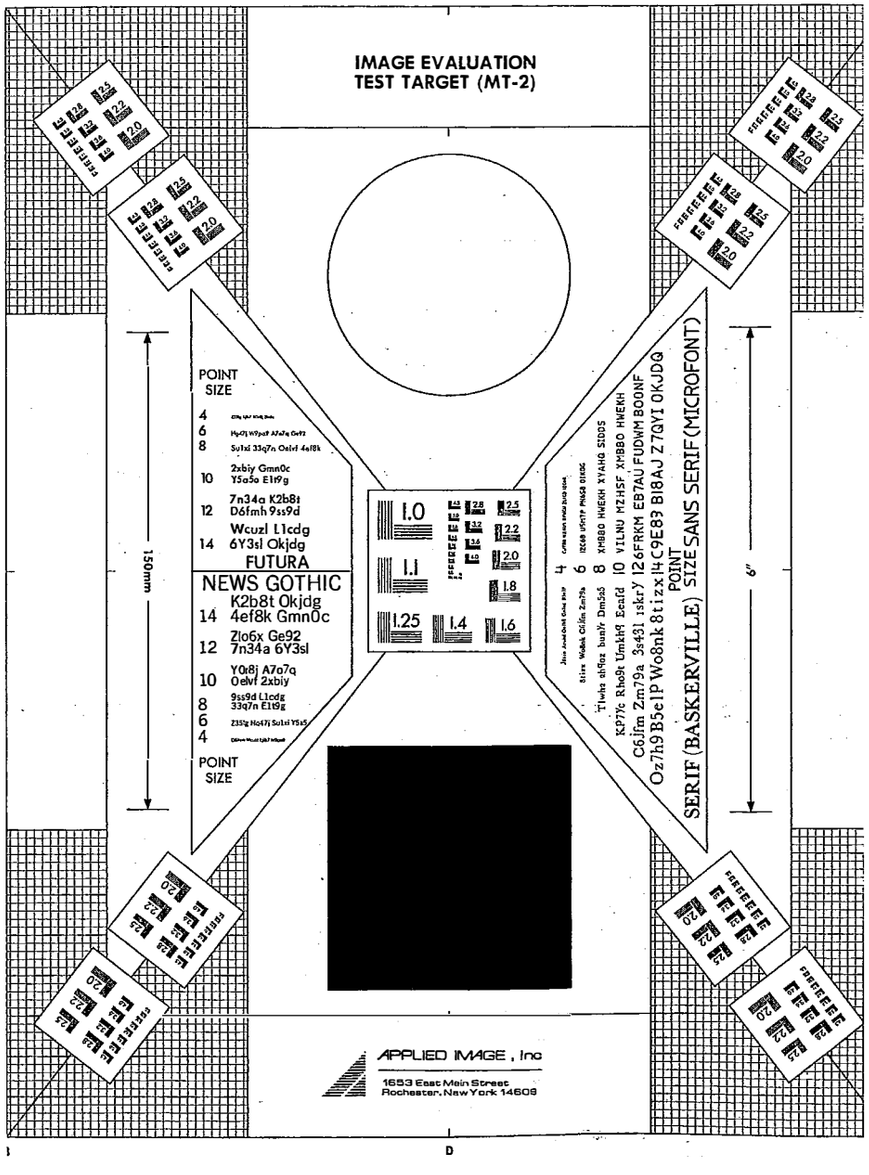
Les méthodes de microfilmage suivies sont conformes aux politiques du ministère et aux normes applicables.

Date Microfilmed – Date du microfilmage

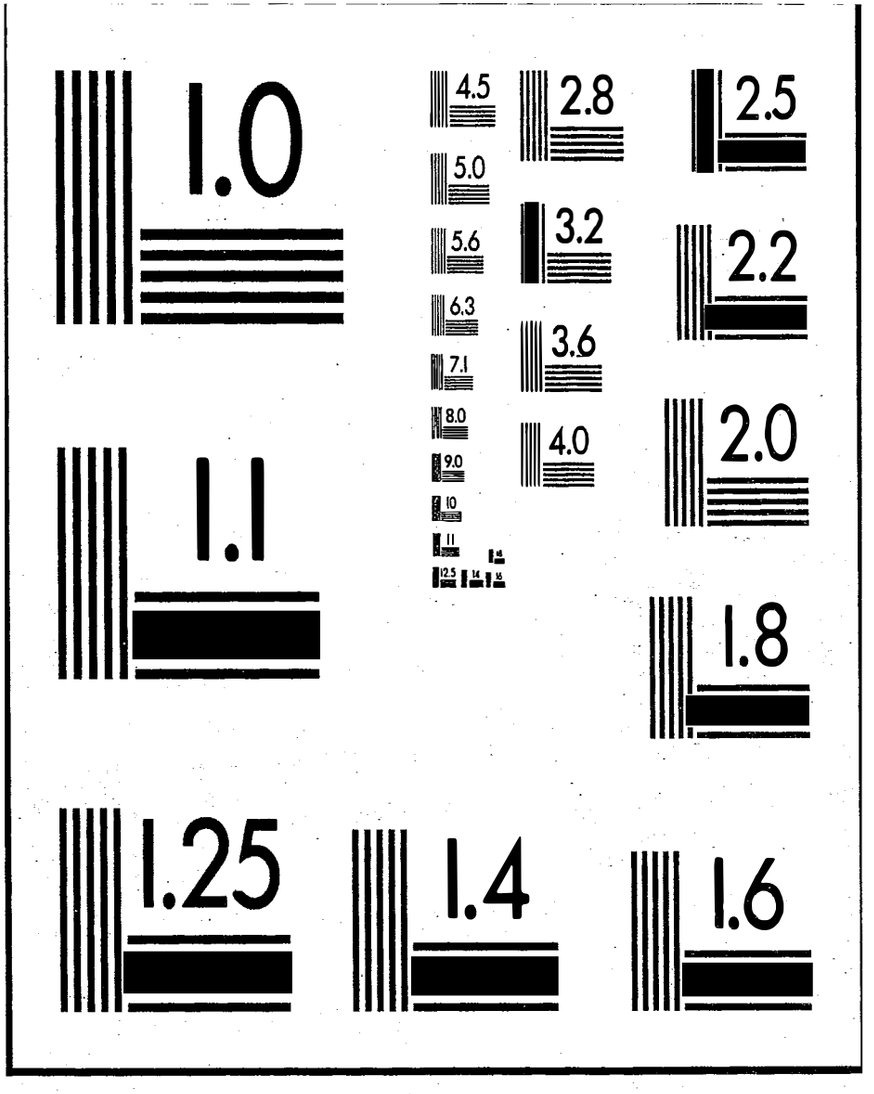
Camera Operator – Opérateur de la caméra

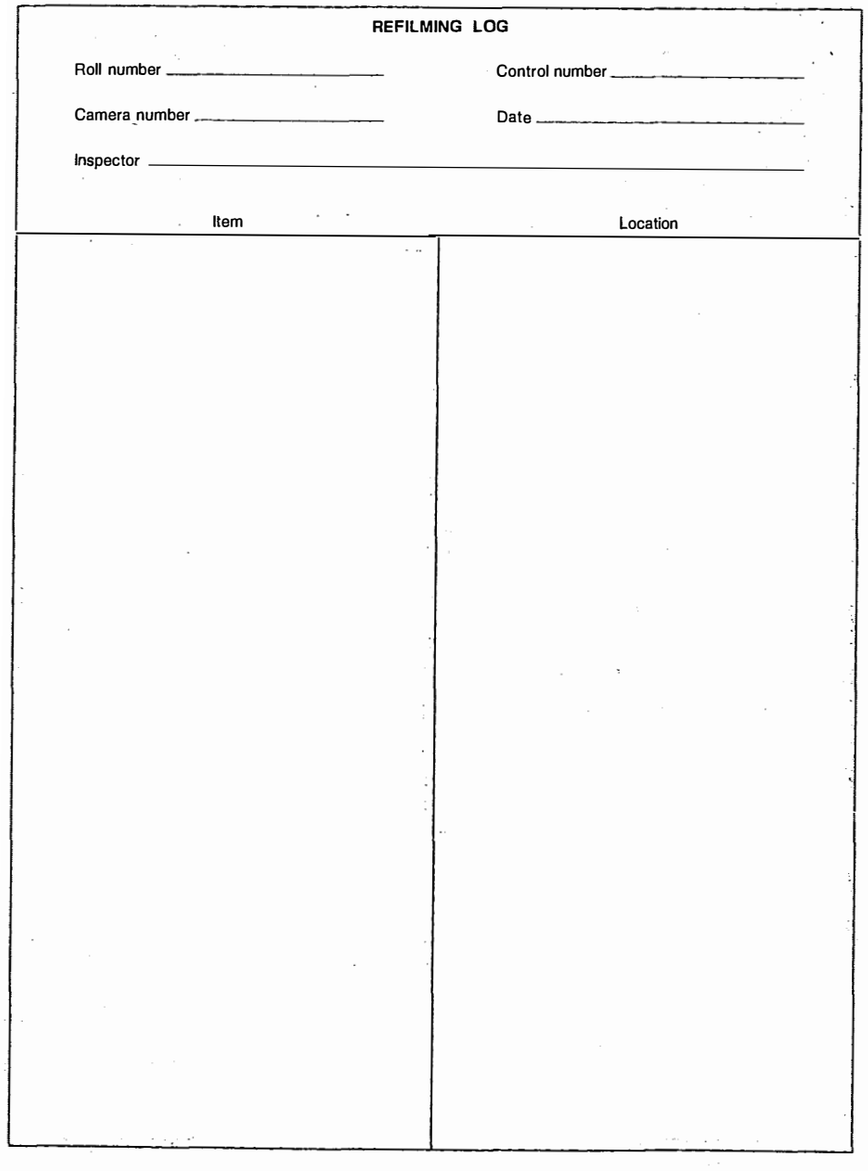
Authorized Signature – Agent autorisé

END FIN



Microcopy Resolution Test Chart





REFILMING LOG

Roll number _____ Control number _____

Camera number _____ Date _____

Inspector _____

Item	Location

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CXXVII. UNIONE ITALIANA DELLE CAMERE DI COMMERCIO, INDUSTRIA, ARTIGIANATO E AGRICOLTURA, *Guida agli archivi storici delle Camere di commercio italiane,* a cura di ELISABETTA BIDISCHINI e LEONARDO MUSCI, Roma 1996, pp. XLII, 194, illustrazioni, L. 21.000.

CXXVIII. *Gli Archivi Pallavicini di Genova.* II. *Archivi aggregati. Inventario* a cura di MARCO BOLOGNA, Roma 1996, pp. XII, 476, L. 37.000.

CXXIX. ROBERTO MARINELLI, *Memoria di provincia. La formazione dell'Archivio di Stato di Rieti e le fonti storiche della regione sabina,* Roma 1996, pp. 316, L. 18.000.

CXXX. ARCHIVIO DI STATO DI FIRENZE, *Imperiale e real corte. Inventario,* a cura di CONCETTA GIAMBLANCO e PIERO MARCHI, Roma 1997, pp. VIII, 532, tavv. 22.

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33. *Le fonti diplomatiche in età moderna e contemporanea. Atti del convegno, Lucca 20-25 gennaio 1989,* Roma 1995, pp. 632, L. 54.000.

34. *Gli archivi per la storia dell'alimentazione. Atti del convegno, Potenza-Matera 5-8 ottobre 1988,* Roma 1995, tt. 3, pp. 2030, L. 132.000.

35. *Gli archivi degli istituti e delle aziende di credito e le fonti d'archivio per la storia delle banche. Tutela, gestione e valorizzazione. Atti del convegno, Roma 14-17 novembre 1989,* Roma 1995, pp. 702, L. 28.000.

36. *Gli archivi per la storia della scienza e della tecnica. Atti del convegno internazionale, Desenzano del Garda, 4-8 giugno 1991,* Roma 1995, tt. 2, pp. 1338, L. 97.000.

37. *Fonti archivistiche e ricerca demografica. Atti del convegno internazionale, Trieste, 23-26 aprile 1990,* Roma 1996, tt. 2, pp. 1498, L. 70.000.

38. *Fonti e problemi della politica coloniale italiana. Atti del convegno Taormina-Messina, 23-29 ottobre 1989,* Roma 1996, tt. 2, pp. 1278.

39. *Gli archivi dei partiti politici. Atti dei seminari di Roma, 30 giugno 1994, e di Perugia, 25-26 ottobre 1994,* Roma 1996, pp. 420.

40. *Gli standard per la descrizione degli archivi europei. Esperienze e proposte. Atti del seminario internazionale, San Miniato, 31 agosto-2 settembre 1994,* Roma 1996, pp. 454.

41. *Principi e città alla fine del Medioevo,* a cura di SERGIO GENSINI, Roma 1996, pp. X, 476, L. 65.000[1].

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XX. ARCHIVIO CENTRALE DELLO STATO, *Fonti per la storia della scuola.* III. *L'istruzione classica (1860-1910),* a cura di GAETANO BONETTA e GIGLIOLA FIORAVANTI, Roma 1995, pp. 442, L. 31.000.

XXI. ARCHIVIO CENTRALE DELLO STATO, *Fonti per la storia della scuola.* IV. *L'inchiesta Scialoja sulla istruzione secondaria maschile e femminile (1872-1875),* a cura di LUISA MONTEVECCHI e MARINO RAICICH, Roma 1995, pp. 642, L. 51.000.

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XXIII. *I Libri Iurium della Repubblica di Genova,* I/2, a cura di DINO PUNCUH, Roma 1996, pp. XIV, 574, L. 41.000.

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