

BRITISH
LIBRARY

FUTURE LIFE OF COLLECTIONS

Report on a meeting on
Applied Conservation Research,
held at The British Library on
27–28 September 2004

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Introduction

This report is a record of the discussions at the meeting held at The British Library on 27-28th September 2004, to discuss the development of a strategy for applied conservation research into paper-based library and archive materials in the United Kingdom and Ireland. This meeting was a sequel to one convened by the Andrew W. Mellon Foundation on 16th September 2003, at which a group of conservators and scientists active in conservation research was invited to outline the current trajectory of scientific enquiry related to the conservation of paper materials.

Representatives from the six legal deposit libraries and two national archives attended, together with representatives from national libraries, research establishments and teaching institutions in North America and Europe. Nine of the participants were invited to give brief oral presentations on where they felt the emphasis of future research should lie. This report does not aim to be a verbatim account of the proceedings, but rather aims to highlight the most salient points made by the participants in the course of their presentations and in the subsequent discussions. The Background (p 8) and Context of Strategic Research (p 10) papers in particular are more developed versions of oral presentations given on the day.

Before the meeting, the following documents were circulated to all participants, in order to give common points of reference for the discussion:

Excerpt from Commission on Preservation & Access Newsletter 62: Science Research Initiative Sets Priorities
ICOM-CC Graphic Documents Working Group Programme 2002-2005

Notes of the meeting held at the Andrew W. Mellon Foundation on 16th September 2003
Update to Preservation Science Survey (Porck & Teygeler, CLIR, 2000)
British Library Conservation Research Strategy
The National Archives Preservation Research and Development Strategy

The last four items form Appendices 2 – 5 of this report.

The remit of the meeting was originally restricted to paper-based collections, but during the discussion it was agreed that parchment and leather should be included, because parchment forms a major part of archival collections, and leather is the major component of many bindings. Digital preservation was excluded from the discussion, not because we thought that the problems of digital preservation were unimportant, but to keep the area of discussion manageable. The aim throughout was to have a free debate which led to peer agreement on the priorities for conservation research, and a framework within which this could be carried out.

Executive summary

The delegates to the meeting generated a large number of ideas, which were drawn together into the following three over-arching themes. These are the agreed priorities for applied conservation research into paper-based library and archive materials in the UK and Ireland:

- 1 Life-cycle prediction, natural ageing of materials, evaluation of preservation strategies for different materials.
- 2 Effects of the storage environment and selection of the optimum environment for different materials.
- 3 Non-destructive methods for assessing damage to materials.

The British Library will take the lead in developing a coherent work programme by:

- Circulating outline projects and establishing consensus with colleagues in the legal deposit libraries and national archives in the UK and Ireland, by the end of January 2005.
- Fleshing these ideas out into a number of costed work strands with a clear timetable, initially for the period 2005 – 2010, by the end of April 2005.
- Involving collaborators in North America and Europe whose expertise and facilities complement those available in the UK and Ireland. We will ensure academic research in universities combines with more practical research in libraries and archives, so that the results can be applied to collection-centred problems.

Foreword

Helen Shenton, Head of Collection Care, The British Library

We are creating a new Centre for Conservation at the British Library, the vision for which combines state-of-the-art book conservation studios and technical sound studios; public access with behind-the-scenes tours and an educative outreach programme; conservation training in collaboration with a partner university and a clear national focus for the application of scientific research on materials to the conservation of library holdings.

We established the first Conservation Research post at the British Library in 2003 with the explicit understanding that we will not create multi-million pound state-of-the-art research labs. What we do have is the most fascinating and challenging range of questions about the incomparable collections. What we do have is unique material – what was termed ‘the romance of the collections’ during the two day meeting. What we do have are questions about how we should care for those collections that are relevant and transferable to any library. The Mellon meeting proved that what we also do have is a very willing international network of potential collaborators.

The British Library was delighted to host the roundtable and is very appreciative of the Andrew W. Mellon Foundation’s support making it possible. There is a long and very fruitful association between the British Library and the Mellon Foundation, from the Mellon Microfilming Project to the International Dunhuang Project to the current collaboration with the New York Public Library in areas such as 21st Century Curatorship. This present initiative came about at the end of a visit by Don Waters (Program Officer for Scholarly Communications at the Mellon Foundation) to Lynne Brindley (Chief Executive of the British Library) in 2002, when we described our aspiration to establish applied conservation research at the British Library. The model we were envisaging was a collaborative one, because there was so little such activity visible in libraries and archives in the UK and Ireland. This model chimed with discussions underway in the US. The Mellon Foundation convened a meeting in September 2003 at its headquarters in New York for US and European participants, to brainstorm the research needs for specifically paper-based collections, using the model that the Foundation had used for museum and gallery conservation research a few years earlier.

The subsequent meeting at the British Library in September 2004 set out with the aim of trying to agree a framework for applied conservation research for libraries and archives in the UK and Ireland.

On a personal note, I found the two days to be extremely energising and inspirational. There was a remarkable and noteworthy degree of engagement and consensus. The debate, the essence of which is hopefully captured in this report, was stretching for everyone.

I am not a scientist. I am interested in things such as nanotechnology and robotics and Smart materials for their future application, both as an individual and in a professional capacity, responsible for the stewardship of a national library’s collections. In some ways, I am the person in the street at whom the ‘Public Understanding of Science’ is aimed, to use the phrase current in the UK. By telling the story of the past, present and future life of collection items and by telling the story of the life cycle of the materials and techniques used to conserve collections, we can extend understanding of those elements that will have an impact on the future of the written memory to a wider audience.

The application of scientific research to the conservation of documentary heritage can not only help with developing new materials and techniques, but it can also occupy that centre ground between Arts and Science. The arts/science interface reflects the British Library’s very core, being an organisation spanning disciplines in the humanities, social sciences, technology, science and medicine across the world’s collections. The application of scientific research to the conservation of the documentary heritage can also create a new middle ground between Science and Preservation Management.

Whilst the remit of this meeting was applied conservation research for specifically paper-based collections and explicitly excluded digital collections, nevertheless, the discussion inevitably ranged over digital material. There was recognition of the complementarity and increasing interdependencies of digital and paper-based material – the two were not necessarily in tension. Also, it may well be that

this way of approaching applied conservation research for paper- and parchment-based material may be a model for applying research to digital life cycle issues.

I would like to record our thanks to the Andrew W Mellon Foundation for enabling the meeting to happen. I would like to thank the contributions of every individual participant. I would like to acknowledge the enormous contribution of Nancy Bell and especially Barry Knight, and support from other British Library colleagues in particular Lynne Brindley, Clive Field and Shirley O’Neill.

Background

Thoughts on the context of conservation research for archive and library collections in the UK

Nancy Bell, *The National Archives, UK*

When thinking about the purpose of this meeting, to establish a conservation research strategy for library and archive collections for the UK, two questions emerged: Why now in the UK? Why not before? A few obvious answers are readily apparent. The vision of Helen Shenton, Chair of this two-day forum, is testament that individuals who perceive a need can, with sustained energy and focus, make things happen. Equally the support of the Mellon Foundation in enabling the convergence of so many expert contributions is no less significant. Nevertheless, given the many practical reasons which help to explain 'why now', the more difficult question is 'why not before?'

Simply stated, conservation science research can lead to a better understanding of the materials used to create historic artefacts, their interactions, and subsequent progress of deterioration. This can help to revise and improve thinking which in turn leads to better practice and the preservation of collections. The importance of scientific research as an aid to conservation is well established thanks to pioneers such as E. Forbes, G. Stout, and others of their generation who believed 'technical understanding of the materials of construction could help to preserve the physical evidence of the past'. Since these early years, conservation research has evolved, and is viewed as a necessary element to informed thinking from item level treatment to larger issues of collection care. Nevertheless, while the potential for science, technology, and research to inform what we do is well understood, its full exploitation, particularly in the context of library and archive collections remains under-exploited. Why is this so?

BLURRED VISION AND A SMALL SLICE OF THE PIE

One obvious impediment in the UK has been the lack of a coherent conservation research programme for libraries and archives. The absence of a shared research purpose or even an imperative, has kept the importance of conservation research off the agenda on an institutional level as well as nationally. The effects of this have been far reaching. Until this year none of the Legal Deposit collections, or National Archives, have had dedicated funding for research staff or facilities

in place. Consequently conservation research for libraries and archives in the UK has been somewhat idiosyncratic although there have been a number of large-scale projects such as the investigations funded by the British Library into the potential for co-polymerisation as a paper strengthening technique.

PROBLEMS OF TRANSLATION

For a research programme to flourish effectively, dissemination and integration of conservation research at many levels and to a broad church of potential users – preservation administrators, scientists, librarians, archivists, conservators etc. – is essential, although seldom does this occur. This is not a recent problem; indeed a comprehensive survey undertaken by the American Institute for Conservation in 1994 indicated that there was a

'need for wider dissemination in the conservation field of technical information originating in allied scientific fields; and a need for greater awareness and education on the part of practising conservators regarding the nature of laboratory research, how it is conducted, its limitations and practical benefits, and how research results can be meaningfully translated into improved conservation practice.'¹

Improving translation will only be possible if more effective ways of transferring specialist knowledge and research to the non-specialist are overcome. Conservators find it difficult to exploit fully conservation research and when confronted with practical problems needing practical answers, the conservation literature is often very difficult to interpret and equally difficult to turn into method. As with most scientific results it is often very difficult to meet the expectation of translating the particular to the general. This situation will only improve with continued and systematic exchanges between specialists, and learning to share and understand the vocabularies of allied disciplines – what Jonathan Ashley-Smith calls 'staring down each other's mine-shaft.'²

More research, more literature, but who reads? Retrospectively we know that the 1970s and 1980s gave rise to a huge expansion in scientific

literature, which mirrors a similar growth in conservation training programmes and professionalism generally. Similarly, the past ten years have seen the explosive growth of the World Wide Web, which has meant that vast quantities of information, often of dubious quality, are now available to anybody at the touch of a button. This means that the task of interpreting and assessing the reliability of information is even more important than before. According to Joyce Hill Stoner, the increased use of the web means that people are publishing more, but for whom?³ A recent ad-hoc poll of some twenty conservators agreed they viewed access to conservation literature as essential to their work, but admitted not having referred to any specific articles in the last twelve months. If this is in fact the case generally, the challenge is to find more effective methods of distilling, interpreting and disseminating the results of research to our audience.

Underlying the problem of effective dissemination and meaningful translation is a more subtle issue of quality. A few sobering observations: at present mainstream conservation journals are not rated as highly as other professional literature, particularly when compared to the published record of, for example, other sciences. Indeed a recent review of the main peer-reviewed conservation journals found that the UK academic ratings were poor, with only one given a rating of 0.5 out of a possible 10 points. The obvious consequence is that there is no incentive for researchers whose professional existence is measured by published outputs to submit their work to mainstream conservation literature and therefore a corpus of important allied literature is seldom accessed, if at all.

DELIVERABLES: PRACTICAL OUTCOMES AND THE ART OF PATIENCE

Conservation science seldom, if ever, delivers a profit, and indeed some argue seldom delivers a dividend. In the project-driven, risk-averse working environment, a long-term commitment to conservation science research raises a number of contradictions. Conservators want practical answers to what to do with the object on the bench, administrators want clear deliverables for their investment. Delivering practical outcomes that can directly improve conservation practice takes time, even decades, and seldom does our vision extend for that length of time.

Finally, the need for setting priorities for conservation science research is well established, as evidenced by a number of key reports published in the last twenty-five years, mostly in North America. The 'Report of the Study Committee on Scientific Support' (1979) concluded that identifying the scientific needs for conservation was necessary to establish research priorities representing museum interests for the US. Subsequently, through the support of the American Institute for Conservation Task Force on Conservation Science an updated version was published by the National Institute of Conservation (NIC) 'Proposed Priorities for Scientific Research', although this was primarily museum focused. In 1994 The Commission on Preservation and Access

convened a meeting representing preservation administrators and scientists to establish research priorities. This was followed by a report in 2001 from The European Commission on Preservation and Access and later up-dated by the Council on Library, Information and Research in 2000. In total the corpus of published reports, forums, and discussion provides an impressive dossier of what conservation professionals view as the main questions which need to be addressed. This meeting will take forward the research agenda for the UK by highlighting the need for focused research amongst partners, and translating this research in a meaningful way to a broad span of conservation and preservation professionals.

REFERENCES

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- 2 Ashley-Smith, J., 'Science and Art: Separated by a Common Language?', V&A Conservation Journal, 36 (Autumn 2000), 4-6.
- 3 Stoner, J. H., American Institute for Conservation News, November 1995, 19.

The context of strategic research in the conservation of paper-based library and archive material

Barry Knight – *The British Library*

THE PRESENT STATUS OF STRATEGIC CONSERVATION RESEARCH

The general state of conservation research is good; much solid work is being done and is being reported at conferences and being published in journals. Some nations are clearly punching above their weight – Slovenia is an excellent example – while others are apparently punching below, for example, comparatively little is coming out of the USA, despite its size. However, this may be a problem of dissemination on the one hand, and of awareness on the other. Some journals have only a limited circulation, and some conferences are poorly publicised outside their own countries or are attended by comparatively few people. Language is still a barrier, and people who do not publish in English, or who only publish in the grey literature, may find that their work is ignored by the majority of conservators and conservation scientists. Nevertheless, the 70-page report by Porck and Teygeler (2000) is an impressive summary of an impressive quantity of recent work, and Appendix 3 to this report by Nancy Bell (p 28) brings this up to date.

However, the aim of this meeting is not to examine past and current research projects through the microscope. Rather, it is to take a broad view of all of this work, so that we can see the big picture and identify the big themes, and think about where conservation research should be going in the next five to ten years. We need to step back for a moment and get a sense of what it is that unites these projects, the common thread that runs through them. Ultimately what we are concerned about is caring for our collections, but our actions might be directed towards finding out what is wrong with a particular item, or what remedial treatments might be applied to it, or how it can be prevented from deteriorating in future. The idea of a research strategy is that it should identify these unifying themes and prioritise them, so that individual researchers can see how their individual projects fit into the bigger picture.

The meeting at the Andrew W Mellon Foundation in New York in September 2003 was a first step towards identifying these priorities, and thanks to the continued generous support of

the Mellon Foundation we are able to take this forward at this meeting.

An important function of this meeting will not only be to identify what ought to be done, but how it should be done. We have to face the political and economic reality that conservation science is competing alongside many other deserving causes for a limited pot of public and private funding. Within institutions, the competition for funds between different departments is even more intense: conservation research will be competing directly with conservation and preservation, and will have to make a very convincing case if it is to receive any support at all. Nevertheless, we have to make the case for the importance of conservation research in ensuring the long-term preservation of library and archive material – they are the basis of cultural heritage, and in many ways documentary heritage defines national identity. Think of the founding documents that are so important to us: Magna Carta and the Domesday Book in Britain, the Declaration of Independence and the Constitution in the USA, for example.

However, we cannot just rely on sentiment for making our case for conservation research; we need to make a sound business case as well, demonstrating good value for money and clear benefits that outweigh the costs. One of the most effective ways of making the pound or the dollar or the euro go further is by forming partnerships with other organisations: by putting together a number of small amounts of money one can build up a large amount of money with which it is possible to do something worthwhile. This is the strategy we are pursuing at The British Library.

THE WIDER CONTEXT OF CONSERVATION RESEARCH

At the present time, there is concern over the future of science in the UK. Science teaching in schools and universities is under pressure: science degree courses are closing because they are more expensive to run and require more expensive facilities than arts courses. There is difficulty in recruiting school science teachers because science graduates can earn more money working for

financial institutions than as teachers. This means that science is increasingly taught by unqualified people, which further reduces the number of children who are interested in science as a career.

Another consequence of this is that there is a bigger gap than ever in the public understanding of science; this means that the public find it very hard to make judgements on scientific issues, and the quality of the information on these issues that they find in the media is generally poor. The British Library, along with many other institutions, is committed to addressing this gap: the wealth of our current and historical science collections makes this a natural activity for us.

Conservation science is particularly well placed to contribute to the public understanding of science; it stands at the interface between arts and science, and the results of the application of scientific research to the solution of conservation problems are easily and graphically demonstrated. This is one of the advantages and principal selling points of conservation: conservators work on objects that are visual, and the results of their interventions are usually apparent even to the untrained eye. People are generally interested in conservation, and conservation science adds an extra dimension to the story. Understanding the conservation problem and appreciating the role of science in solving that problem helps to develop a better understanding of the role science plays in people's lives.

THE CONTEXT OF CONSERVATION RESEARCH IN THE BRITISH LIBRARY AND THE NATIONAL ARCHIVES

Both institutions have recognised the role that conservation research plays in underpinning the activities of their conservation departments, and that research is vital in developing new techniques and in updating and validating existing techniques. As a result, both institutions have recently appointed Heads of Conservation Research, in the persons of Barry Knight and Nancy Bell.

However, neither institution has research facilities – in fact, no library in the UK has conservation research facilities. Only the largest museums and heritage bodies have any kind of facilities for undertaking conservation research, and some of these are under threat due to retirements and internal reorganisations. There is no laboratory in the UK dedicated to research on the conservation of library and archive materials. Nevertheless it is clear that other libraries look to The British Library and the National Archives, as the national bodies, to provide leadership in conservation research, and we are determined to provide this.

The resources of The British Library and the National Archives are always under pressure, so there is no prospect of either body setting up a conservation research laboratory in the foreseeable future, nor is this necessarily the best way forward. The only way forward is by collaborating with other libraries and with other relevant bodies, such as the newly-combined Department of Textiles and Paper at Manchester,

the Textile Conservation Centre at Winchester and the Leather Conservation Centre at Northampton. In fact, equipment relevant to our needs exists in a number of places, so it would be unnecessary to duplicate it. In the same way, a wealth of scientific and analytical equipment exists within University College London, literally across the road from The British Library, and it is far more cost effective to pay for their services than to acquire and run comparable equipment ourselves.

One of the first tasks of the Heads of Conservation Research in both institutions has been to compile a conservation research strategy. These strategies reflect the different aims and priorities of the two organisations, and are conditioned by the nature of their collections. For example, the British Library's strategy dwells on the problems relating to the conservation of books, documents and newspapers, while The National Archives' focuses on parchment and newer materials such as tracing films and fax paper. (At The British Library modern materials are covered elsewhere in the organisation.) Nevertheless, there is much that is common to both documents, and we intend to collaborate fully with each other in tackling these common problems.

However, the aim of this meeting is to go beyond these purely organisational strategies and to identify national and international priorities for research into the conservation of paper-based library and archive materials. As I said at the beginning, what we want to do is to draw together the various strands of research into a few big themes that will act as an umbrella. By showing there is solid international support for these themes, we hope that we shall be able to convince funding bodies that real and substantial benefits will come from funding research in these areas.

THE FUNCTION OF CONSERVATION RESEARCH AT THE BRITISH LIBRARY

The emphasis is on applied conservation research: research needs to produce results which either enable a conservator to conserve an object more effectively, or which enable a researcher to understand an item better. For the conservator, this means developing less interventive treatments, minimising the change in appearance of objects and reducing their rate of deterioration, so that the interval before an item needs to be treated again is increased. The research should ideally relate to whole collections, rather than to single items. For the researcher, it means understanding the materials and techniques used and understanding the changes that have occurred over time. Particularly important is the ability to reveal text that has become faded or obscured, or which has been deliberately erased. As an example, we are looking at techniques borrowed from paintings conservators for examining manuscript illuminations. An awareness of current trends in humanities research will enable us to engage with curators by suggesting examination techniques that could be useful for their studies. Although traditionally we have interacted with the 'fine art' end of rare books

and manuscripts, both western and oriental, we must not neglect other parts of the collections. We particularly need to demonstrate the value we can add in the areas of science, technology and medicine.

For our own conservators, we hope that conservation research will lead to the development and the adoption of improved techniques, which will contribute to their own professional development and bring them greater job satisfaction. The challenge is how to bring about the transition from research results to changes in conservation practice, and this is one of our greatest priorities. It is partly an issue for researchers, to make sure that their work is practically oriented, partly a challenge for conservation scientists to perceive the practical applications of research and to translate it into conservation procedures, and partly a learning and development issue for conservators themselves.

There are barriers which tend to make conservation research less accessible to conservators than it could be, one of which is the academic standing of conservation journals. In order to enhance their standing in the academic world, researchers in universities need to publish in journals which are highly rated by the peer review process. Unfortunately, conservation journals are not scientific enough to be highly rated (if at all) by scientists, while highly-rated scientific journals are generally too technical to be understood by conservators. This is similar to the difficulties in promoting greater public understanding of science, as popular science writing is likewise not rated by the peer review process.

Nevertheless, there is an important role for conservation research to play in outreach as well as public understanding of science. People look to The British Library and The National Archives for authoritative conservation advice, and as publicly funded bodies it is our duty to provide this. Our audience is not just conservators and other conservation scientists: we also need to reach preservation and conservation administrators, library managers and architects and engineers who are responsible for managing library buildings and the mechanical and electrical plant in them. We need to engage with exhibition planners and designers, to ensure that conservation and the results of scientific examination are integrated into exhibitions, and are not viewed as a separate activity. Good recent examples are the incorporation of the Raman laser identification of pigments into the Lindisfarne Gospels exhibition, and the use of hyper-spectral imaging in the examination of palimpsests.

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Summary of Presentations

DR JANA KOLAR – HEAD, NATIONAL CENTRE FOR PRESERVATION OF LIBRARY MATERIALS, NATIONAL AND UNIVERSITY LIBRARY OF SLOVENIA

There has been a general lack of resources for library and archive collections in Slovenia since independence in 1991, due to other national priorities. For this reason it has been essential to rely on collaboration with other bodies, and in particular on funding received from the EU for research projects. Nevertheless, conservation research in the National and University Library is flourishing, because it has been based very firmly on an analysis of the needs of the collection, supported by hard statistical evidence gathered through condition surveys.

For example, a survey showed that iron gall ink corrosion was endangering 50% of the manuscript collection: this led directly to the EU-funded InkCor project (2001-04), which has investigated the causes of iron gall ink corrosion and methods of treating it. Dissatisfaction with condition surveys, that they were neither objective nor reproducible, led to the SurveNIR project (2004-07), which aims to develop a near infra-red instrument for objectively measuring the degree of degradation of paper. Doubts about the long-term effectiveness of mass deacidification methods have led to the PaperTreat project (2004-07), which will compare the commercially available treatments and how the properties of treated paper change on ageing.

Similarly, the variety of proposed aqueous and non-aqueous treatments for paper affected by iron gall ink corrosion has led to a desire for standardisation of testing and treatments, so that the effects of different treatments can be compared between institutions. There are continuing concerns about the role of copper in ink corrosion and the effects of gelatine in stabilising it. Further investigations are underway in association with the Netherlands Institute for Cultural Heritage.

The effects of the climate on the condition of the Library's collections are a cause for concern, so the effects of fluctuating relative humidity and of air pollution are being investigated, the latter in the

light of the long-term experiments carried out at the Dutch National Archives on the change in condition of collections stored in vaults with and without filtered air. The effects of microclimates on collections are also being investigated, particularly examining the influence of volatile organic compounds and the effects of using boxes made from board containing zeolites to absorb these substances. More work needs to be done on other preservation options, such as storage under low oxygen, cold storage and storage at low RH.

On the wider stage, the library is interested in developing standards for materials and in developing standardised test procedures to enable comparative analysis, since this is not possible at present. Analytical methodologies need to be founded on good science, and many pure scientists are interested in applications of their techniques in the cultural heritage field. For example, Prof Wess at Cardiff University has applied synchrotron radiation to the examination of historic parchment, and there are similar opportunities for applying other techniques. Collaboration with established researchers in the field is the only way in which conservation scientists can gain access to such expensive equipment.

PROF GERHARD BANIK – DIRECTOR OF STUDIES, STATE ACADEMY FOR GRAPHIC ARTS, STUTTGART

Conservation researchers are often confronted with pressing practical problems needing immediate answers – for example, what to do with books that had been damaged in the Weimar fire, or with a collection of photographs that had been frozen after being damaged by the floods in Dresden. Otherwise, there may be straightforward technical questions, such as whether treatment with magnesium alkoxide is effective against copper pigment corrosion. One of the most important contributions of conservation scientists is in developing appropriate technical standards; sometimes it is possible to adopt diagnostic tools used in the paper and cellulose industries, sometimes we will need to develop our own. For example, in the case of mass deacidification, it is difficult to compare and evaluate the different commercially-available treatments because of a

lack of documentation: there need to be more independent tests on the effects of these treatments on papers, books and bindings. Other examples are the measurement of alkaline reserve: there is no agreement on how much is needed or on how to test for it, and on standardised methods for artificial ageing. When carrying out condition surveys, damage assessment is often done on an all-or-nothing basis, but what is really needed is an intelligent understanding of the extent of the damage and its seriousness.

Much of conservation research is materials research; we need to borrow and adapt the techniques of materials researchers. However, the application of research findings to practical treatment options is often limited; in many cases this may be due to the fact that research is carried out on model materials such as Whatman paper. This makes it difficult to translate the results from pure research to real historic materials.

From the point of view of the educator, an important problem is the lack of science education of conservators. Many conservators do not have a science background, which makes it very difficult for them to evaluate the results of scientific research. This needs to be tackled both by raising the level of scientific awareness of conservators and by scientists making efforts to make their results accessible to conservators.

The main starting point for identifying research needs in a library or archive is the collection. Short term research projects, lasting maybe one year, could relate to problems encountered in daily conservation practice, such as consolidation or strengthening of paper. Such projects could be carried out in house. Medium term projects, lasting two to four years, might relate to developing treatments for serious conservation problems where no suitable treatments exist, such as copper pigment corrosion of paper. These projects could only be carried out in partnership with an institution with experience in the field of cellulose chemistry. Lastly, there are long term projects, lasting five to ten years, which investigate some basic scientific problem. An example could be the investigation of the ageing characteristics of paper and the development of non-destructive tools to describe its state of preservation. Such a project would be carried out by a research institution, but would be supervised by the library to ensure that it remained focused on practical goals.

DR HENK PORCK – CONSERVATION SCIENTIST, THE ROYAL LIBRARY OF THE NETHERLANDS

To give a brief overview of areas of conservation research in which recent progress has been made, we should particularly mention the field of ink corrosion, which is much better understood now, thanks mainly to the InkCor project (2001-04). Five years of study have brought us close to understanding the complex deterioration mechanisms of corrosive ink and a clearer idea of how it can be treated. For non-acidic papers, oxidative degradation of cellulose may be more

important than acid hydrolysis. The Papyrus project (2001-04) has now given us the ability to monitor oxidation in real time, under conditions not too far removed from ambient. This gives rise to the possibility of carrying out natural ageing studies in real time, and should definitely be pursued.

In addition, there are challenges that still exist, which should be addressed in our international research agenda. One of the main ones is dissemination of existing information; telling the story. By this is meant emphasising the importance of the material cultural heritage, and the importance of conservation in maintaining access to it. We live in an age where the importance of conserving and preserving original objects is sometimes forgotten. We must not lose sight of the artifactual value of library and archive collections, and this story needs to be told repeatedly. The importance of this in building political support for conservation initiatives cannot be over-emphasised: the Delta Plan in the Netherlands, a blueprint for conservation of the nation's museum collections which was launched in 1990, was developed in the light of publicity arising from an audit report which highlighted the poor state of many Dutch museum collections. We have to emphasise the value of original artefacts, and how we can add to their value by means of research. Collaborations between institutions are key to doing this successfully.

Another challenge that still remains is the problem of deacidification, and in particular the selection criteria for deciding which items will benefit from treatment or which are too brittle to benefit from mass treatment. Modern paper is generally not acid, but it contains materials such as optical brightening agents and recycled material of unknown composition, which may affect its stability. As yet the effects of these materials have not been studied. Then there is the issue of the influence of air pollution, both externally generated and internally generated by the slow degradation of paper. We need more research into the effects of these substances in order to be able to set threshold values for them.

DR STEPH SCHOLTEN – NETHERLANDS INSTITUTE FOR CULTURAL HERITAGE

The Netherlands Institute for Cultural Heritage (ICN) is an interdisciplinary team, bringing together conservators, chemists, physicists and archivists. It was formed in 1997 by the merger of the Central Research Laboratory for Objects of Art and Science, the State Training School for Conservators, and the Netherlands Office of Fine Arts. As part of the Delta Plan for the preservation of the cultural heritage, the Dutch Ministry of Cultural Heritage has put an emphasis on conservation research. Conservation research has traditionally been evaluated according to scientific criteria, but these are not necessarily relevant to conservation. At the ICN, the emphasis is not so much on scientific novelty as on practical utility.

The ICN has been collaborating with the Dutch National Library (KB) and the Dutch National Archives in assessing and managing the risks to

their collections, using the model developed by Rob Waller, the Chief of the Conservation Section at the Canadian Museum of Nature. The difficulty with risk assessment for library and museum collections is that the most serious risks are those that cause loss of their cultural value, not monetary value. The approach is to quantify the risks and to prioritise them; ICN has developed a soft mathematical model that enables a semi-quantitative approach to risk assessment. This is an improvement on the traditional methodology that tends to focus on catastrophic all-or-nothing events, but does not work so well for slow changes or partial damage.

Since 2001, the ICN has also been collaborating with the KB on the Metamorfoze project, which aims to microfilm all Dutch books and newspapers produced between 1840 and 1950, and to digitise and deacidify a limited selection of these. As with the original Delta Plan, it had been important enter into dialogue with library managers and politicians to gain support for the programme, in order to obtain funding. This was achieved by emphasising the importance of the documentary heritage to understanding the history of the Dutch nation, particularly its colonial history.

PROF PAUL WHITMORE – DIRECTOR, ARTISTS' MATERIALS CENTER, CARNEGIE MELLON UNIVERSITY

The key to successful conservation research in the library and archive sphere is a better co-ordination of efforts, concentrating on things that other institutions cannot do, or which libraries can do better. Therefore libraries and archives should concentrate on studying their collections, both single objects and groups of objects, and highlight their continuity over time, their breadth and depth and the treasures of the collections. Preservation issues should be closely linked to this study of the collections. There are many advantages in focusing on libraries' own collections – it is easier to argue for the value of original artefacts rather than surrogates, the treasures are instantly identifiable and might attract interest from academic institutions, excitement could be generated through 'telling the story', and the findings would be of immediate relevance to the collections. For example, it is possible to look at real time ageing processes, and to examine retrospectively the long-term effects of old conservation or restoration processes. The breadth of library collections also means that it is possible to look not only at the average condition but also the extremes of well and poorly preserved items. In this way one obtains information about the range and variability of condition, and the way in which objects in different states of preservation respond to standard treatments.

As an example, Carnegie Mellon University has undertaken a survey of light-sensitive blue pigments in its Japanese print collection, with a view to revising exposure limits for certain pigments. This was an application of techniques that had already been developed and therefore did not require highly trained scientists to carry it out. Conservation researchers should aim to

develop similar techniques that could be applied by conservators without a science background.

CHRIS WOODS – HEAD OF PRESERVATION & COLLECTION CARE, BODLEIAN LIBRARY, UNIVERSITY OF OXFORD

There are many tools and scientific techniques that already exist, which could be applied to conservation research. They need to be looked at creatively to see how they could be harnessed to meet conservators' needs. For example, one of the most interesting developments at present is the analysis of volatile organic compounds by headspace analysis and solid-phase micro-extraction (SPME), which has been pioneered by the Centre de Recherches sur la Conservation des Documents Graphiques in Paris. This promises rapid and non-destructive determination of the condition of paper and the possibility of identifying marker compounds which indicate the degree of degradation.

Much information already exists which has not been communicated effectively. It would be a great advance to set up a data centre to capture information from research projects and make it available through IT networks. Using standard templates could be a way of making the data manageable and reliable.

From the point of view of things which the legal deposit libraries (the six libraries having the right to receive one free copy of every book published in the UK) and the national archives in the UK are well positioned to do, a central store of conservation information and the analysis of conservation records would be valuable. All these institutions have long histories of conservation and restoration, which means that the long-term effects of old conservation treatments and materials could be assessed. Similarly, they are well placed to collaborate in matters such as the sharing of analytical equipment.

DIANNE VAN DER REYDEN – CHIEF OF CONSERVATION DIVISION, LIBRARY OF CONGRESS

The Preservation Directorate at the Library of Congress (LC) has twelve major research programmes in progress. Some of these are on-going, continuous projects, while others are more short-term in nature.

Quality Control Program: This is a core program to test the huge range of supplies used by LC for protecting collections. In addition to testing supplies for adherence to LC specifications, the Directorate also performs quality control testing on two major treatment programs that are outsourced on contracts: the mass deacidification and the paper strengthening programs. This program is not without its problems: testing every batch of all the materials used is an organisational challenge, and as it may take two or three months to complete a series of tests there can be considerable delays in accepting or rejecting batches of material.

This can lead to shortages of materials in the conservation studios.

Analytical Services on Demand Program: This is another core program of great importance for Divisions in the Directorate and elsewhere in Library Services, providing a wide range of analytical and technical support to curators and conservators on request.

Accelerated Ageing of Paper Project: This work is extremely important in developing and evaluating a new approach to accelerated (also called artificial) ageing of paper. As a direct result of research by Dr Chandru Shahani on accelerated ageing of paper, conventional testing methodology is being questioned for its compatibility with the natural ageing process. In work presented by LC at a seminar sponsored by the Institute for Standards Research at ASTM, the potential for a new standard test was demonstrated that would be appreciably faster (3 days versus the 30 days presently required) and would involve ageing in closed tubes rather than in expensive humid ageing chambers. Work is now in progress with financial support from ASTM to develop an accelerated test that could be accepted as a standard for gauging the permanence qualities of paper. The new test would not only bring about savings in time and money, but would also simulate the natural ageing process more closely.

Natural Ageing of Paper Project: This project involves ongoing, long-term collaboration with a number of institutions. This work seeks to evaluate the 'natural' ageing behaviour of a number of different types of paper, stored in participating institutions, by drawing samples every two years and submitting those samples to a wide array of tests and analyses. A second set of samples was drawn recently and is undergoing testing.

Zeolites Project: The Nielsen-Bainbridge company, a supplier of conservation and preservation supplies, has donated funding to the Preservation Directorate to defray the expenses for a named research fellowship, dedicated to research into the use of zeolites, especially when incorporated into mat-board, to reduce pollutants (externally or internally generated) in the collection storage environment. The work will build on research performed at the Getty Conservation Institute. An advisory committee that includes the present Chief, James Druzik of the Getty Conservation Institute and Dr. Lambertus van Zelst, will supervise the project.

Pressure-sensitive Adhesives Program: The need to develop specifications for pressure-sensitive adhesive labels, used widely in this institution and libraries and archives everywhere, has led to research in the Division into the nature and properties of the adhesives, the stability of the paper or film stock, and the physical stability of the character image printed on these labels. A particular challenge has been to investigate the effects of cold storage on adhesion. This work has enabled the Library to establish specifications for suppliers. However, it was recognized that there would be great value, both for the Library and for the library and archive community at

large, to develop a generally recognized set of standards for these materials, and the American Society for the Testing of Materials (ASTM) established a sub-group.

Iron-Gall Ink Project: The problems posed by the deterioration of paper induced by iron-gall inks are widely known; yet much research is still needed to study the actual degradation mechanisms and to develop and evaluate treatment technologies for the vast amounts of materials in collections that are affected by this phenomenon. In a collaborative project that involves staff of the Conservation Division and Preservation Research & Testing Division, research is being done on the efficiency and effects of various treatments, including calcium phytate, using a group of well-controlled samples, prepared especially for the project. A variety of tests and analyses will be performed on these samples to gain a comparative insight into the efficacy of these treatments.

Paper Strengthening Project: A pilot project to evaluate the paper-splitting process has resulted in successful treatment of 30,000 too-brittle-to-serve documents by the Zentrum für Bucherhaltung in Leipzig, at a quarter of the estimated cost. Nevertheless, this still amounted to approx \$4 per sheet. A drawback was that the paper-splitting machine was unable to handle some US newspapers, which were of a larger format than German ones.

Environmental Monitoring Project: Preservation Environmental Monitors (from the Image Permanence Institute) have been installed in 95 locations in the three Library of Congress Capitol Hill buildings and Landover Annex. Data from the monitors has been recorded, evaluated and used to lower the temperature and relative humidity in some locations in order to exponentially extend the life of the collections stored in those areas. Maps of the HVAC systems have been made and analysed for future improvements.

Mass Deacidification Program: The Library has awarded a production contract to Preservation Technologies, Inc. to use its Bookkeeper III deacidification process to neutralize acid in over 250,000 books (off-site) and over a million document sheets (on-site) to ensure uniform, effective deacidification treatment and to enhance work flow, including document handling, storage, packing, and transportation procedures. Particular attention has been paid to selection criteria. The Bookkeeper method deacidifies paper when it is immersed in a dispersion of extremely fine magnesium oxide suspended in a fluid. The cost is approx 14c per sheet.

CD-DVD stability: In the area of non-paper-based media, the principal ongoing research is in the long term stability of CDs and DVDs. The work done in the Division has mainly been centred on CD-ROMs. The project has two approaches: one a real-time evaluation of long term signal stability in CDs from the Library collections, of which a sample set is intermittently called from the collections and evaluated using special signal testing equipment; the other the development of

a procedure for accelerated ageing of CDs, with subsequent evaluation using this ageing protocol. The Division has a collaborative arrangement with the National Institute for Standards and Technology (NIST), where similar work is ongoing on DVDs; currently negotiations are ongoing on an Inter Agency Agreement, where special funding from the Library would enable NIST to expand their participation in this work and bring a scientist on board who would be resident at the Division, specifically to work with Division staff on the project. A specialist engineer has been retained on a contract to assist in evaluating the test data and adapting, as necessary, the testing and ageing protocols.

Digital Imaging of Recorded Sound: An ongoing project is aimed at studies of cylinders using three dimensional (3D) imaging methods. A first study has been done on an Edison cylinder and submitted for publication by Lawrence Livermore Labs. Among the questions to be addressed in a second phase of the project are scanning speed optimizations, measurements of damaged and mouldy samples, and comparisons of 3D and 2D scans on laterally modulated disc media.

Integrated Pest Management: The Directorate is also responsible for managing the IPM program throughout the Library's buildings, analysing and plotting the results and planning remedial actions.

PROF JAMES REILLY – DIRECTOR, IMAGE PERMANENCE INSTITUTE, ROCHESTER INSTITUTE OF TECHNOLOGY

From the point of view of cost-effectiveness, and the condition and usability of the whole collection, mass treatments for library items must be more important than the treatment of single items, however significant in themselves. This applies equally to preservation actions such as microfilming. In the same way, a balance must be struck between preventive and remedial actions. To ensure that robust preservation decisions are taken, the selection criteria for preservation or conservation or both must be watertight and the decisions well documented.

The challenge for conservation research is to define what we need to know in order to be able to do what we need to do. When we look at deterioration, we need to decide what kinds of decay or change are significant and which are acceptable. In this context, the concept of the just noticeable change is valuable. Some kinds of changes in appearance are more acceptable for some kinds of material than others. Conservation options need to be examined in the light of overall strategy, taking into account the consequences of each decision. We cannot hope for absolute standards of preservation and access; what we should aim for is efficient stewardship combined with reasonable access.

As far as storage conditions are concerned, we know that cooler and drier conditions lead to longer lifetimes, but the challenge is to define conditions that can be achieved cheaply without compromising preservation. Reducing the

temperature to 50°F (10°C) and not insisting on close control and constancy will have very considerable benefits. The Time-Weighted Preservation Index is a tool for assessing the effects of a fluctuating environment in a manner that is believed to model realistically the behaviour of real collections.

ELLEN CUNNINGHAM-KRUPPA – DIRECTOR, KILGARLIN CENTER, UNIVERSITY OF TEXAS

The William and Margaret Kilgarlin Center for the Preservation of the Cultural Record focuses on research on a number of inter-related topics, namely the management of the documentary heritage, digital archiving, conservation treatment, preservation of the record of cultural communities and preservation of recorded sound. The Center pursues its research agenda by promoting research by faculty and students and by collaborating with other institutions and organisations. Its graduate certificates form the premier programme in the US for the training and education of professionals in the fields of preservation and conservation of library and archive materials, including paper-based collections, magnetic media and digital objects.

It is important to identify measures that bring the greatest success in preserving collections, and to target research on them. A survey of expenditure in American research libraries revealed that 60% of budgets was spent on personnel, 30% on library binding, and the remaining 10% on all other forms of conservation and preservation, including reformatting and mass deacidification. A very small amount was spent on conservation research. In view of the proportion of expenditure devoted to staff, it is crucial to make sure that their work is properly directed. It is of key importance to understand the environment in managing collections, and since highly-controlled environments are highly dependent on fossil fuels, their future sustainability is an issue. Building design is important for cost-effective environmental control solutions, but it is also necessary to be prepared to look for compromise approaches if optimum storage conditions are too expensive to achieve.

Priorities for research

In the final session delegates were asked to give their three highest priorities for future work, to indicate where they thought research efforts should be concentrated. 35 priorities were suggested (some received more than one vote) and these are listed in the Appendix below. On reflection, these can be grouped into larger families of related topics, and it is suggested that these should form the basis of the future research agenda. The most important of these families relate to:

- 1 Life-cycle prediction, natural ageing of materials, evaluation of preservation strategies. (12 votes)
- 2 Effects of the storage environment and selection of the optimum environment for different materials. (11 votes)
- 3 Non-destructive methods of assessing damage to materials. (11 votes)

Other topics that received significant support include:

- 4 Characterisation of materials, development of appropriate standards and test methods.
- 5 Evaluation of present and previous treatment methods, standards and quality criteria for treatments.
- 6 Research on the conservation of specific materials and the effectiveness of specific treatments.

Other comments related to the importance of developing simple treatments that could be easily applied by conservators without specialised equipment, and the importance of documentation, cross-sectoral collaboration and training. These are important messages that should be taken on board by the conservation world generally, not just those involved in book and paper conservation.

Behind all the research areas mentioned here is the idea that a book or document is a composite object, made of several different materials, each of which has its own ageing characteristics and which is subject to specific forms of deterioration. In order to understand the total lifecycle of an item we need to understand the lifecycles of the individual materials that go to make it up, the chemical and physical changes which they

undergo as they age. We need to know what are the most significant forms of damage, in terms of their effects on the usability of the item. We also need to understand the effects of the storage environment on the rate of ageing of different materials, so that we can predict which material will ultimately determine the limit of practical usability of a book or document, and concentrate our preventive efforts on that.

1 LIFE-CYCLE PREDICTION

This family includes the measurement of the natural ageing of materials, the ageing and behaviour of materials late in the life-cycle, quantitative modelling of the effects of existing conservation and preservation options on the life-cycle, and a cost-benefit analysis of different preservation strategies, leading to reliable predictive modelling. All of these suggestions take forward the work which the British Library is already undertaking on life-cycle modelling, but add some intriguing new dimensions. Thus, although our aim is to retard the deterioration of books and paper as far as possible, we have to accept that many of our holdings have already deteriorated, and we cannot suppose that the properties of deteriorated materials are the same as undeteriorated. A study of the further ageing of already aged paper would be illuminating.

Similarly, there was considerable dissatisfaction with, or even distrust of, the results of existing accelerated ageing studies. It is felt that the conditions under which these studies are conducted are too far removed from normal conditions to be a reliable guide to the behaviour of real materials. This has led to an emphasis on real-time ageing studies and the development of sensitive instrumentation that can measure the deterioration of paper under conditions not too far removed from normal, such as the chemiluminescence instrument developed as part of the recently-concluded Papyrus project, supported by the EU.

Conservation treatments are undertaken in response to some kind of damage which an item has sustained, but little is known about the long-term effects of conservation treatments on the lifetime of items. It is assumed that treatments are

benign and will prolong the lifetime of objects, but history has shown that some past treatments have had the opposite effect in the long term, though doubtless they were satisfactory in the short term. Further investigation is needed in this area. There was also backing for projects to develop our knowledge and understanding of the properties of materials used in the production of library and archive materials, especially materials used in the past. This was combined with the desire to know more about the properties of conservation materials, particularly in the long term.

Finally, a cost-benefit analysis of the effects of different preservation strategies on the life-cycle of materials would lead to better-informed decision making on conservation and preservation options. Too often radical decisions affecting the preservation of whole collections are undertaken on the basis of incomplete knowledge of the true costs in the long term.

2 THE STORAGE ENVIRONMENT

In this family the perceived need is for better definition of optimum storage conditions for different types of materials and discovering whether there are threshold values (for example, for the concentration of pollutants) above which the deterioration of different materials is accelerated, improved understanding of microclimates (in rooms, cupboards or enclosures) and the influences of changes in the environment, more particularly the rate of change. There is concern that we do not know enough about the properties of buildings and how they affect the storage environment, or that this information is not accessible enough to conservators. Finally, there is a need to understand what effects a low-oxygen storage environment will have on the deterioration of materials.

Work by the Image Permanence Institute is addressing the issue of optimum storage conditions, while current research (recently summarised by the Canadian Conservation Institute) suggests that there are threshold values for the concentrations of many common inorganic and organic pollutants acting on substrates such as paper, leather and photographic negatives and prints, but that these levels are very sensitive to temperature and relative humidity. Further work needs to be done to extend and refine these values, covering the whole range of library and archive materials.

In spite of many years' work on the effects of the environment on library and archive materials, we still do not know enough about the factors that lead to the creation of localised microclimates, or about the behaviour of deliberately created microclimates, such as polyester enclosures. Since this type of storage is increasingly used it is important that its consequences should be understood. In the same way, although a lot is known about building physics and the influence of construction on the internal environment, much of this material is highly technical and inaccessible to the average conservator. Efforts need to be made to make this information, and the practical consequences that flow from it, more widely available in the conservation community.

3 ASSESSING DAMAGE TO MATERIALS

This family is concerned with the assessment of damage to library materials, in particular the difficulty of deciding which damage factors are most significant. This is an on-going problem with condition surveys: how should we rate the relative importance of different kinds of damage, as they affect the stability of an item or its usability, and how should we assess the relative importance of different kinds of damage presented by the same item? There is a desire for simple non-destructive testing methods that would simplify the process of condition surveying, and for a uniform method of undertaking preservation needs assessments based on standardised and reproducible surveying techniques.

While it is relatively easy to survey a collection and identify various forms of damage, it is much more difficult to identify the risk factors that may lead to further deterioration. Equally, some forms of damage, such as yellowing of paper, may be obvious but may not affect stability or usability greatly. Such occurrences should perhaps be looked on as being natural changes rather than damage, and therefore should not be rated as highly significant. More work needs to be done to establish the relative importance of these changes.

Currently, all condition surveys are done by simple visual assessment of condition. There is a need for objective non-destructive methods for assessing the condition of paper, so as to remove the necessity of using destructive techniques such as tensile strength or double-fold testing. In this regard the new EU-funded SurveNIR project is a welcome development. This project aims to develop a portable near infra-red spectrometer that will enable the non-destructive quantification of the breakdown products of paper, thus enabling a quantitative assessment of the degree of degradation.

The need for objective survey methods is also evident from the fact that two conservators examining the same collection will often come up with different assessments of its condition. The degree of variation can be reduced by using formal survey protocols, where all the terms are carefully defined and different types of damage are illustrated. This is being attempted for parchment in the EU-funded IDAP (Improved Damage Assessment of Parchment) project, and this approach needs to be extended to other materials and to whole collections, but without making the survey process too lengthy and laborious.

APPENDIX – LIST OF PRIORITIES

Research topics suggested by the delegates.

- 1 Materials life-cycle: measuring rates of decay (8 votes).
- 2 Optimum storage environment for different types of materials.
- 3 Conservation staffing and training (2 votes).
- 4 Iron-gall ink: more research?
- 5 Parchment.
- 6 New-build – need to know more.
- 7 Evaluation of previous materials and techniques – and reversal.
- 8 Developing knowledge and understanding of materials (2 votes).
- 9 Decay assessment: what are real dangers? (3 votes).
- 10 Finding optimum storage conditions: threshold values (6 votes).
- 11 Digital preservation.
- 12 Usability – involve users.
- 13 Understanding micro-climates.
- 14 Smart materials (2 votes).
- 15 Development of non-sampling techniques.
- 16 Criteria for indicators of damage.
- 17 Appropriate test methods.
- 18 Influence of changes in the environment.
- 19 Standards and quality criteria for intervention (4 votes).
- 20 Diagnostic tools (5 votes).
- 21 Quantitative modelling of effects on life-cycle of available conservation and preservation options (2 votes).
- 22 Integrated 'magic bullet' for mass de-acidification, iron-gall ink and physical strengthening.
- 23 Effects of wet treatments.
- 24 Greater inter-sectoral collaboration.
- 25 Practical simple solutions.
- 26 Preservation needs assessment based on standardised damage surveys (2 votes).
- 27 Cost-effect analysis of preservation strategies leading to reliable predictive modelling.
- 28 Development of standards.
- 29 Evaluation of de-acidification processes (2 votes).
- 30 Study of ageing of materials late in life-cycle.
- 31 Documentation of our preservation knowledge: standardised approach to enable retrieval.
- 32 Qualitative and quantitative characterisation of historic materials.
- 33 Establishing accessible repositories.
- 34 Effect of alkalisation on modern writing materials.
- 35 Time-weighted preservation index for oxygen levels.

Next steps

Having identified the three 'Big Themes' that received the greatest amount of support from the delegates, The British Library is now working through the practical consequences.

- In January 2005 we will circulate our first thoughts and establish a consensus amongst our colleagues in the legal deposit libraries and national archives in the UK and Ireland.
- By April 2005 we will have worked these ideas up into concrete proposals to produce a coherent programme consisting of a number of costed work strands and a clear timetable, initially for the period 2005-2010.
- We will involve collaborators in North America and Europe whose expertise and facilities complement those available in the UK and Ireland. We will ensure academic research in universities combines with more practical research in libraries and archives, so that the results can be applied to collection-centred problems.

We believe that what makes the legal deposit libraries distinct from all others is their collections. No other libraries can compare to their breadth of coverage or their historical depth. Their legal deposit status means that copies of the same books should be found in each library, enabling comparisons to be made of their condition which will reflect differences in their storage environment, patterns of use and conservation history. This makes them ideal subjects for non-destructive research into the natural ageing of materials, the performance of previous conservation materials and methods, and the impact of different preservation strategies. The responsible stewardship that we owe our collections means that we should be concerned for the storage environment and providing the best possible conditions for their long-term storage. Finally, in order to plan for timely and cost-effective treatments we need tools to enable us to assess the condition of materials simply and non-destructively.

In addition to these three themes, there was a recognition that the standards and test methods which are widely used by conservators were developed by the paper and pulp industries to meet

their own needs, and those of their major customers in the printing and packaging industries, and do not necessarily correspond to the needs of conservation. The forces experienced by paper in a book when it is being read are not to be compared with those experienced while it is being printed and bound. The criteria for the strength of paper must relate to the uses to which it is put. There was support for the idea that conservators should develop their own specifications and test methods where these were felt to be appropriate.

To address this need, The National Archives has already taken the lead in setting up a consortium, with the backing of the British Library, which will carry out tests on widely-used conservation materials and making the results available, at least in the first instance, to colleagues in the legal deposit libraries in the UK and Ireland, The National Archives and the National Archives of Scotland. The consortium eventually intends to look at the issue of standards, and how conservation-related performance standards could be written. The National Archives has also set up a database of materials formerly used in book and paper conservation, which in the first place will enable the chemical nature of a product to be identified from its trade name, and in the second place will enable its ageing characteristics over time to be determined. The first results will be available early in 2005.

Appendices

Appendix 1

List of attendees at the meeting

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Appendix 2

Notes of the meeting held at the Andrew W. Mellon Foundation on 16th September 2003

The meeting was convened by Don Waters, Program Officer for Scholarly Communications at the Andrew W. Mellon Foundation, and aimed to help the Foundation to understand the current trajectory of scientific enquiry related to the conservation of paper materials. Ten conservators and scientists active in conservation research were invited to give presentations on their current research and to answer the question 'On what issues and problems related to conservation would you be working if there were no barriers or constraints?'

Following the main meeting, the discussion continued informally, with those present (Helmut Bansa, Gerhard Banik, Paul Whitmore, Season Tse, Chandru Shahani, Henk Porck, Robin Clark, James Reilly, Barry Knight), chair (Helen Shenton), in attendance (Hans Rütimann), addressing the three issues posed by Don Waters at the end of the main meeting, namely:

Issue 1

What did the group think of the Andrew W Mellon Foundation funding a strategic project on conservation research that would produce a conservation research agenda?

Issue 2

What subject areas were missed at the main meeting?

Issue 3

Who else should be involved?

ISSUE 1

- The group unanimously and heartily endorsed the proposal that the Mellon Foundation support a strategic project that would set out the conservation research framework for paper-based materials and articulate the need for conservation research in the field.
- The group unanimously agreed the need for such a strategic position paper that would assist a business plan for conservation research, aimed at mobilising the community, attracting new scientific talent into the field, and fashioned with audiences of future funding

bodies in mind. This would help structure the medium to long-term agenda for the discipline.

- The group unanimously re-affirmed that this strategic framework should address paper-based collections only.
- It was agreed that a research agenda was needed that supported preventive, not interventive, conservation; that supported the management of whole collections rather than individual objects and that identified and supported the most important research topics that would ensure the long-term survival of the paper-based, documentary heritage.
- The overall theme for conservation research should be aimed at minimising damage, mapping the deterioration path of paper and managing the mechanisms of deterioration.
- The strategic framework can build on the notable degree of consensus already evident from the preceding eight presentations. The areas of commonality emerging were:
 - 1 The need for tactical, strategic and applied conservation research rather than fundamental science. This should include the improved transfer of applicable knowledge from other scientific disciplines.
 - 2 The need for the profession to 'tell the story' of conservation research, relating the science much more closely to the collections. This is not only to enable effective lobbying to funding bodies and political agencies, but also to promote a broader 'public understanding of science'. Therefore there is a need for different, improved methods of communicating the reasons for, and the outcomes of, conservation research such as outreach materials for education. This will help address the issue of the arts/science interface, making it a benefit rather than a disadvantage.
 - 3 Closely linked to this is the need for an overarching business plan for conservation research for paper-based collections, given

that preservation does not currently have a 'value proposition'. A sound business plan should include cost-benefit analyses, benchmarking and risk management tools.

- 4 The need for predictive data modelling to support the management of collections was repeatedly mentioned. Reliable models are needed that will allow the reasonable prediction of the lifetime of paper as a function of treatment, storage and display environment. The qualitative measuring and mapping of decay is required, from which predictive data models of deterioration can be developed.
- 5 Qualitative data from risk management models is needed, on which informed decisions can be taken about the management of paper-based collections. Dynamic risk models of cellulose degradation that will predict life expectancy in the presence of different internal and external environments are needed.
- 6 This is closely related to the lack of certainty of accelerated ageing methods to predict the natural ageing behaviour of paper. Therefore, there is a need for real-time, long-term studies on naturally aged, real objects, rather than relying on accelerated ageing tests. This would aim to monitor the state of degradation of different papers over time.
- 7 There is a need to take an engineering approach to the development of new diagnostic tools (in particular non-destructive techniques) that allow conservation professionals and researchers to evaluate and verify the quality and effectiveness of treatments. This will also enable the monitoring of the condition of treated items and the rate of deterioration over time, as well as the evaluation of the efficacy of treatments. There is a need to identify, develop, verify and standardise simple, accurate, sensitive, non-destructive, quantitative methods of cellulose degradation analysis.
- 8 The effect of macro and micro-environments on paper-based material was raised on several occasions in relation to the previous points.
- 9 The maturing of the field was recognised, with the move away from single item-level research to preventive collection-wide research; with the recognition that there is no single 'magic bullet' solution to the preservation of paper; and that there is now a sufficient body of conservation treatment documentation that can be a valid branch of study in itself that can be used for 'real-time' extrapolation of deterioration rates. Linked to this, is the need for improved scientific description of materials, both used in objects and as used in conservation.

ISSUE 2

- The main issue that was not explicitly raised at the meeting (but is implicit in many of the suggestions) is the need for effective collaboration.

ISSUE 3

- Representation from the Paper Industry had been mentioned at the meeting, or research bodies with a link to the Paper Industry, such as the UMIST Paper Technology Department. Representatives from other national libraries, national archives and research institutes were also suggested.

NEXT STEPS

- Finally, there was universal support for a follow-up meeting to complete the discussion that was slightly truncated at the end of the earlier presentations. All present were willing to continue to be involved. It was suggested a date be set within the next three months.
- Helen Shenton offered for the next meeting to be held at the British Library in London, if this would be helpful.

Appendix 3

Update to Preservation Science Survey (Porck & Teygeler, CLIR, 2000)

Nancy Bell, *The National Archives, UK*

The publication *Preservation Science Survey* by Henk Porck and René Teygeler (CLIR 2000) made a significant contribution to the on-going development of preservation science research. This seminal publication captured in a single authority the range of preservation science research projects in Europe, North America and Australia between 1995 and 2000. More importantly, and no less significantly, the CLIR report presented a global approach to preservation science, which extended significantly the scope and opportunity for greater and more meaningful collaborations.

This paper summarizes the preservation science research projects now underway since the publication of the *Preservation Science Survey*. It roughly follows the same format of the CLIR publication and uses the same broad categories of information carriers as set out by Porck and Teygeler – paper, film, and magnetic tape – with the addition of skin materials (leather and parchment) and modern media. These additional categories were considered worthy of inclusion as they form significant components of library and archive collections, as well as being the subject of several key research projects currently being supported through European Union funding. As with the CLIR report, this summary gives particular attention to emerging technologies that have the potential for large-scale application.

This update of the *Preservation Science Survey* is based on the author's scan of the major conservation research centres, personal communication with research scientists and reviews of related literature in full knowledge that routine emendations will be required to keep this as an organic and useful place of reference.

A SUMMARY OF PRESERVATION SCIENCE TO 2000

Underlining the points raised in the CLIR report, the trend in conservation research in libraries and archives from 2000 continues to move away from detailed analysis of individual items to a broader focus aimed at answering large-scale preservation questions. Indoor air pollution, ink corrosion, the efficacy of mass deacidification products, and the stability of nitrate and acetate film images were the focus of numerous projects up to 2000. There

was a conspicuous absence though of European research in the area of film, photo, and tape preservation, with little or no research on durability or permanence standards for paper.

Significantly the report highlighted a greater emphasis on interdisciplinary approaches to research and an integration of preservation science into management and policy making. Interdisciplinary activity remains a key word in preservation science research, due in part to the recognition that projects benefit enormously from cross collaboration and funding opportunities are broadened. The decrease in on-site science and technology resources in many museums, libraries and archives, has given rise to an increase in integrated partnerships, particularly within the University sector; this is a trend likely to continue.

The report also made a significant point: the link between research findings and dissemination to the wider professional community of conservators and preservation administrators, conservation scientists etc. remains an obstacle and needs to be addressed.

Porck and Teygeler concluded that there remained significant gaps in research, in the following areas:

- Standardization of accelerated ageing tests;
- Exploitation of non-destructive micro-analytic tools to characterize the materials of paper and photographic materials to monitor degradation;
- Analysis of preservation initiatives e.g. environmental, storage, the relationship of access and use;
- Absence of on-going research on magnetic media.

It is against this background that a summary of the current preservation science research 2000-2004 is detailed below.

UP-DATE ON PAPER, FILM, MAGNETIC TAPE, PARCHMENT AND LEATHER RESEARCH PROJECTS 2000-2004

1 Paper: decay

1.1 Iron gall ink corrosion

Project: INKCOR (Ink Corrosion – Stabilisation of iron gall ink containing paper, No. EVK4-CT-2001-00049, 2002 – 2005).

Outcomes:

- Database established at ICN (The Netherlands Institute for Cultural Heritage) for recording iron gall ink recipes from collected historical sources, to add to their existing Art Technological Sources database.
- Ink corrosion database, containing visual assessment of historical artefacts.
- Prediction models have been established based on: width of the ink stroke, pH, and weight of the paper and extent of corrosion.
- Tests for iron and copper, for enabling conservators to identify corrosive inks.
- Established that, under alkaline conditions, copper ions are better catalysts of peroxide decomposition than iron ions.

Project: Study of the influence of ink ingredients on IGI corrosion of laboratory samples using different analytical tools: gas chromatography, mass spectrometry (gum and gallic acid) Mössbauer spectrometry, infra-red spectrometry and size exclusion chromatography (cellulose), elemental analysis of original inks on manuscripts using PIXE. (These studies are performed within the French iron gall ink working group coordinated by CRCDG and University of La Rochelle) 2000-in progress.

1.2 Oxidative Degradation

Project: Papyrus (Light emission as a tool to investigate paper degradation, No. EVK4-CT-2000-00038, 2001 – 2005) University of Ljubljana.

Outcomes:

- Construction of a prototype chemiluminometric instrument to non-destructively sample paper.
- Studies indicate the aldehyde groups initiate oxidation after deacidification; the removal of the aldehyde groups during deacidification is beneficial.
- There is a relationship between pH and the rate of degradation – MgCO₃-deacidified materials will degrade faster. This behaviour was not typical of cotton pulps; therefore bleached wood pulps are not good models to study the behaviour of rag papers.
- Results demonstrating the effect of water on oxidative degradation and the related chemiluminescent phenomena have been published.

Project: Size Exclusion Chromatography (SEC): a new tool for the study of cellulose degradation 2000 – 2003 (CRCDG)

Outcome: Published literature

Project: Gelatine sizing of paper and its impact on the degradation of cellulose during ageing. 2001 – 2004 (CRCDG and Anne-Laurence Dupont) Further development of size exclusion chromatography coupled with multi-angular light scattering and differential refractive index detection. This project will also evaluate the degradation of gelatine sized paper during artificial ageing as well as the study of alum on paper.

Outcome: Published literature.

Project: Transition Metals in Paper (MIP) (consortium of European partners) EU project. This project is considering the effects of transition metals, e.g. metal tannin inks, on the deterioration of paper. The aim is to determine appropriate conservation treatments in view of the findings, the development of non-destructive test methods, appropriate environmental conditions, and the effects of deacidification agents on papers containing transition metals.

Project: ASTM Paper Aging Research Program Extensive studies on paper ageing under real-time testing with the aim of revising current ageing standards.

Outcome: Initial results are available from ASTM on CD-ROM, Research Report no. D06-1004

Project: Gloss Measurement (CRCDG) Fundamental studies are underway to determine the physical and physiological parameters necessary to measure quantitatively surface gloss as an alternative to artificial ageing tests.

Outcome: Preliminary results have been published.

1.3 Evaluation of Mass Deacidification Processes

Project: INFOSAVE (2002) British Library Co-operation and Partnership Programme. Assessment of mass deacidification techniques and the identification of methods to determine the amount of endangered material from 1850 to the present, the preferred methods to be used, and to identify the priority categories.

Outcome: published report, available at: www.mla.gov.uk/documents/infosave_rep.pdf

Project: The effects of air pollutants on the accelerated ageing of paper, No. STEP CT 90-0100). Commissioned by the Bibliothèque Nationale de France, and the TNO Centre for Paper and Board Research (Netherlands). It investigated the efficacy of the DEZ (diethyl zinc) gas phase process as run by Akzo Chemicals, Texas; the solvent-based methyl magnesium carbonate (MMC) process, the Sablé process – a modification of the Wei T'o process used at the Bibliothèque Nationale in Sablé, France; and the magnesium butoxytriglycolate solvent-based process used at the FMC Corporation, MG3-Lithco (FMC).

Outcome: Internal report.

Project: SurveNIR (Near-Infrared Reflectance Spectrophotometry (2005 – 2008) EU funding pending) University of Ljubljana. Near-infrared spectroscopy tool for collection surveying.

1.4 Paper: Treatment

Project: Water in Paper (Leonardo Project, No. 112693 2003) Authors/editors: G. Banik and I. Brückle with other supporting partners.

Outcome: Production of a compendium to support the teaching of conservators in the principles of the interactions between water and paper.

Project: Comparative Study of different erasers used in conservation studios (2003). (CRCDG) This project evaluated several kinds of erasers commonly used in conservation treatments, and also the effects of residual synthetic and natural rubbers on cellulose degradation.
Outcome: A scale to aid the conservator in the appropriate selection of materials was published.

2.0 Paper: Storage

Project: Investigation of zeolite molecular traps used in the production of Micro-Chamber board (2004 – ongoing). Library of Congress, USA, and The Getty Conservation Institute.

3.0 Film, Photographic Materials, and Magnetic Tape

3.1 Decay

Project: (Image Permanence Institute, Rochester, USA). Current projects include improvement of hardware and software for environmental monitors, effects of fluctuating storage conditions on collection decay, and investigations into digital image quality.

Project: New test methods based on CIELAB colorimetry, for evaluating the image stability of photographic prints. Image Permanence Institute, Rochester Institute of Technology.

3.2 Testing

Project: Characterisation of silver bromide – gelatine photographic prints (CRCDG) 2001-in-progress. This project aims to develop micro-destructive or non-destructive techniques in order to find some markers to characterise different types of prints.

3.3 Treatment

Project: Development of micro-analytical techniques to identify historic photographic processes. Getty Conservation Institute.

Project: Consolidation treatment for flaking autochrome plates – 2002, CRCDG
Outcome: Published literature

Project: Stabilisation of magnetic audio and video tapes (EU PRESTOSPACE project CRCDG, Institut National de l'Audiovisuel) 2003 – in progress. This project will undertake a material analysis of videotapes to better understand the degradation process.
Outcome: Damage assessment tools to measure the degradation stage of the tape.

3.4 Storage

Project: Storage of early colour photographs in oxygen-free environments and the effect on pigment stability (2001 – in progress) CRCDG
Outcome: The stability of pigments used in early photographic processes in oxygen free environments was investigated and the results published

4.0 Leather and Parchment

4.1 Decay

Project: Improved Damage Assessment of Parchment (IDAP, No. EVK4-CT-2001-00061). EU-funded project to study the damage assessment of parchment at the macro, micro,

and molecular levels. The aim of this project is to assess damage in historical parchments at the macro, micro and molecular levels, providing conservators with information on testing methodology, as well as an early warning system for identifying the condition of parchment. Further information is available on the IDAP web site.

Outcomes:

- Establishing a Parchment Damage Assessment Programme (PDAP),
- Providing an Early Warning System (EWS) of decay and
- Providing a Digitised User-friendly Parchment Damage Atlas (DUPDA), all made available on the Internet.

Project: Collagen Sulfonation. (2000 – 2003) CRCDG Analysis using infra-red techniques (FTIR) and HPLC/ESI-TOFMS, in order to study the effects of SO₂ on collagen and other proteins.

Project: Measurement of Extractable Fat Components on Original Leather Surfaces. CRCDG
 Leather dressings used to improve the mechanical strength and resistance to pollutants were evaluated using an evaluation method designed for this purpose.

4.2 Treatment

Project: The use of micro-focus x-ray diffraction to examine the effect of conservation treatments on the structure of collagen in parchment. Cardiff University, National Archives of Scotland.
Outcome: Published literature

Project: Laser cleaning of parchment – Conservation Centre, Merseyside Museums, Liverpool, Cardiff University, V&A /RCA
Outcome: Published literature.

Project: Craft leather project – EU-funded project completed 2002.
Outcome: Established standards for production of archival quality calfskin.

Project: The effect of Brecknell soap on leather (CRCDG).
 Brecknell alkaline soap (similar to sodium dodecylsulphate) is commonly used for cleaning leather. The long-term effects of this cleaning agent were studied using artificial ageing. Mechanical testing and collagen denaturation temperature were also studied.

Project: Quality control of natural and vegetable tanned calf skins used for book conservation (2003 – present) BNF.
 This project aims to determine whether suppliers followed recommendations for an improved standard of leather for book conservation by the BNF.

Project: Evaluation of the long-term effects of dyes on leathers used in book conservation (2003) BNF, CRCDG.

Outcome: Internal report, CRCDG 2003.

4.3 Storage

Project: Solid Phase Micro Extraction (SPME) and its potential for detecting VOCs (CRCDG)
Outcome: Published results

Project: Development of a Light Dosimeter: LIDO EU-funded Project
 This project aims to develop an easy-to-use light dosimeter, which can provide a quick and visual measure of light exposure of artefacts on exhibition.
Outcome: A commercially available product (LightCheck™)

5.0 Media and Adhesives

Project: Light stability of ink jet prints (CRCDG). The effects of light, relative humidity and temperature on a selection of commercially available inks and papers were studied.

Project: A comparative study of modern stamping inks used for collections. 2003 – present (BNF, CRCDG). A comparative study of different inks used for marking paper artefacts is underway.

Project: The use of Raman micro-spectrometry and PIXE (proton induced X-ray emission) to identify the materials and techniques of artists (CRCDG) 2003
Outcome: Published articles 2004

6.0 Biological Contamination

Project: Disinfection of cinematographic films using gamma rays (CRCDG)
 The use of gamma irradiation as an alternative to ethylene oxide for the disinfection of cinematographic films was investigated.
Outcome: Analysis suggests that the fungi were effectively killed, but the lethal doses cause damage to the film. Published results.

Project: Detection of viable fungal spores on contaminated documents using adenosine triphosphate (ATP) assay. (CRCDG) (2002 – in progress)
 Using ATP as a cell marker is being investigated as an alternative tool for the detection of active fungi before any disinfection is applied.

Project: Identification of fungi using molecular biology (CRCDG) 1998-2002
Outcome: Internal report published 2002

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Appendix 4

A Conservation Research Strategy for the British Library

SUMMARY

This document outlines the British Library's strategy for conservation research. The fundamental principle is that conservation research has to contribute directly to the long-term preservation of the physical collections, either by developing less interventive or more effective techniques for conservation, or by improving our ability to prevent damage to the collections. Wherever possible our tactic will be to form collaborative partnerships with other bodies, both nationally and internationally: libraries, archives or academic institutions, in order to maximise the use of resources and spread the workload.

Applied conservation research also supports the British Library's own research strategy by increasing knowledge about our collections; this provides an extra dimension to original research carried out by users of the library and by curators.

INTRODUCTION

The British Library's consultation document 'New Strategic Directions' sets out the Library's vision – Making accessible the world's intellectual, scientific and cultural heritage – and lists the enabling strategies that will permit this vision to be realised. These strategies are:

- **User focus**
Interact effectively with our users to maximise the fitness for purpose and value of what the Library provides
- **Partnerships**
Initiate and maintain effective partnerships with organisations which have a stake in our activities
- **The Web**
Migrate our traditional service offerings to the Web wherever appropriate, in accordance with users' requirements

The role of Collection Care is to ensure the long-term availability of the collections to all users by preserving both the intellectual content and the physical form of the objects. Conservation Research supports this by:

- Underpinning the activities of Collection Care
- Providing the knowledge base that permits the development of new solutions and their timely delivery
- Supporting the key corporate strategies

Conservation Research is fundamental to well-informed conservation, provides assurance of the validity of its methods and enables the development of new techniques. Within the Library, Conservation Research supports the work of conservators and curators; outside, it complements the work of researchers in universities and research institutes, and professional colleagues in the library and archive world.

The British Library is positioned at the interface between the arts, humanities and sciences. It is a key player in the information society. Conservation research is well placed to contribute to the public understanding of science by demonstrating the significance of the information that can be obtained by applying scientific methods of examination to visually satisfying objects such as illuminated manuscripts. In the same way, conservation research helps to raise the profile of conservation by adding depth to the stories told by our collections through analysis and examination.

For conservators, conservation research enables effective treatment by improving existing techniques or developing new ones, it helps to reduce the rate of decay of collection items by developing methods for removing or neutralising agents of deterioration, and it leads to a greater understanding of the nature of objects by investigation and analysis.

For curators, it enables primary research into the collections by giving an improved understanding of the materials and techniques used in creating an item, and it assists interpretation, for example by revealing hidden information in text that may be faded, obscured or erased.

For researchers and colleagues in other institutions, it facilitates the sharing of information on treatments, techniques and methods of examination.

Conservation Research supports the Library's key strategies in these ways:

1 User focus

Collection Care aims to maximise the availability and fitness for purpose of our collections by:

- Ensuring that objects remain physically available for as long as possible;
- Ensuring that items that are too vulnerable or valuable to be handled are made virtually available by digitising, microfilming or scanning.

Conservation Research will support these aims by:

1.1 collaborating with the ongoing condition survey of the collections: this will give a snapshot of their present condition and will inform future conservation planning.

1.2 undertaking a full assessment of the risks to the collections: this will point up the principal threats to their long-term survival and in particular the relative importance of hazards which are recognised but not necessarily quantified. This will enable us to prioritise our preventive conservation efforts, taking account of the probability of a particular hazard occurring and the proportion of the collection likely to be affected. Major agents of deterioration that threaten the collections include those that are inherent in the materials themselves (eg acid paper, iron gall ink, cellulose acetate microfilm); the environments in which items are stored, displayed and used; wear and tear caused by handling and use; and disasters, principally fire and flood.

1.2.1 Most paper made between about 1850 and 1950 is acidic, due to changes in papermaking technology. Acid paper gradually becomes yellow and brittle, and eventually becomes too fragile to handle. The response to this has been two-fold: firstly to produce surrogates of fragile documents, usually by preservation microfilming, and secondly to develop methods for deacidifying large quantities of material. The British Library has invested heavily in the first of these for many years, but mass deacidification has not proceeded beyond small-scale trials. National libraries in other countries (eg USA, Germany, Switzerland) have invested in mass deacidification, and it appears from their experiences, and from the INFOSAVE project (in which the British Library was a partner), that two of the processes that are commercially available would be viable for the British Library. We will therefore commission a larger-scale study which will examine the technical, organisational, legal, logistical and financial implications of adopting either of these two processes.

1.2.2 We recognise that the existing deacidification processes are still being developed, and that new processes may

emerge in future. We will therefore undertake research to establish the long-term effects of these processes on the chemical and mechanical properties of paper, and the extent to which they reduce the rate of deterioration. In addition, we will investigate whether any of these processes can be modified to strengthen degraded paper.

1.2.3 It is well known that iron gall ink, which was widely used from the Middle Ages until the 20th century, is liable to fade or to damage paper, even to the extent of perforating it. These problems afflict an unknown number of manuscripts in the British Library's collections. We will undertake a survey to discover the extent of this problem, we will examine existing methods of treating affected items, and we will collaborate with international efforts to develop improved methods.

1.2.4 The deterioration of cellulose acetate microfilm affects many libraries in the UK and elsewhere. We will continue to collaborate with international partners to determine the best methods of preserving the content of these films, whether by cold storage, duplication or digitisation.

1.2.5 Although parchment is generally a very stable material, it is susceptible to physical damage in unsuitable or fluctuating environments, and is readily damaged by fungi and bacteria. We will collaborate with international efforts to identify the early symptoms of deterioration before it becomes obvious, and to identify the mechanisms of degradation. In this way preventive measures can be put in place before serious damage is caused.

1.2.6 The longevity of collections depends on the environments in which they are stored, displayed and used. While conditions at St Pancras generally reach accepted standards, those in other locations often do not. We will seek to define the optimum storage and display conditions for different classes of material, and to define more precisely the way in which objects respond to changes in their environment. The results from this work will feed into the design of the new storage building at Boston Spa, and will contribute to the sustainable management of the HVAC systems elsewhere.

1.2.7 Simple preventive measures, such as phase boxing, can protect vulnerable bindings from damage, and timely intervention can prevent minor damage from becoming major. Since prevention is economically and ethically preferable to remediation, we will examine ways in which wear and tear can be minimised by improved handling and boxing, and by the use of more durable materials for

binding. We will also investigate how damage during digitisation, microfilming and scanning can be minimised.

1.2.8 The British Library needs to be constantly aware of the risks of disasters, principally water damage as a consequence of fire or flooding. We will undertake research to explore more effective and low-tech ways of drying water-damaged books and documents, and minimising mould growth. This will benefit not only our own disaster response, but will also benefit other libraries and archives that may experience a disaster.

1.3 supporting the work of conservators and empowering them to develop their own solutions to practical problems.

1.3.1 The Conservation Department recently undertook a review of treatments used in the studios. Comparison with international best practice has brought awareness of the shortcomings of some existing treatments and materials, and as a result, we will focus initially on methods of treating iron gall ink corrosion, leafcasting, and alternatives to lamination. We will encourage and facilitate the adoption of alternative techniques and materials through a programme of technical seminars and practical workshops. This will enable conservators to develop new and appropriate skills that will enable them to adapt to future developments, such as the opening of the British Library Conservation Centre. Wherever possible, conservators will be encouraged to undertake their own research relevant to projects in hand, subject to operational constraints and without detracting from the conservation of the collections. We will assist conservators to develop new treatments and techniques and facilitate the introduction of new materials by carrying out tests on their physical and chemical properties and on their stability, and we will compile databases of materials that are both suitable and unsuitable for use in conservation.

1.3.2 We will support the work of conservators by making available appropriate methods of technical examination and analysis, and by investigating how novel techniques could be beneficial to conservation.

1.3.3 Conservators face the challenges of new materials and new processes introduced into traditional areas, which may have effects on their stability or may pose unexpected problems for their conservation. In papermaking, the increased use of acid-free pulping procedures should lead to a more stable product, but the introduction of optical brightening agents and the increased use

of recycled paper may have the opposite effect. A pilot survey in 2003 showed that approximately 80% of new legal deposit monographs were printed on acid-free paper. However, it is not known for how long these papers will remain acid-free. We will investigate this, and we will extend the survey of the pH of paper to incoming newspapers, periodicals and serials.

1.3.4 In book production, new adhesives and new materials for covers have been introduced. Children's books may incorporate a variety of mechanical parts, or be made of intrinsically unstable materials such as PVC and polyurethane. The convergence of the technologies of photography and colour printing with digital imaging mean that a variety of inks and papers of limited stability may appear in books and documents. Finally, an increasing proportion of the British Library's holdings is in the form of information carriers such as microfilm, magnetic tape, floppy disks and CDs – both as surrogates and as originals, and in books, archives and sound archive material. We will carry out research on the behaviour of all these materials, in order to develop conservation techniques and appropriate preventive strategies before they become serious conservation problems.

1.4 supporting primary research by curators and users of the collections.

1.4.1 Analysis of materials and techniques can assist in understanding the nature of objects and can help in revealing their date and provenance. Scientific examination, for example under infra-red or ultra-violet light, can assist interpretation by visualising faded, obscured or erased text. Techniques used in the examination of easel paintings or miniatures are equally applicable to manuscript illuminations. Awareness of trends in humanities research will enable us to engage with curators by suggesting techniques that could be useful for their studies. We will facilitate such studies, for example by borrowing the methods of molecular biology to identify the species of animal skin used to make parchment, or by adopting techniques used in archaeology for dating paper, leather or boards.

1.5 supporting other activities of the Library.

1.5.1 We will investigate technical solutions that will contribute to the security and ease of retrieval of collection items, such as invisible security marking or radio-frequency identification tags.

Priorities

The risk assessment for the totality of the collections can be viewed as the over-arching priority to which the elements listed above contribute. Within this, we believe that the highest priorities in terms of preventing damage are management of the environment (1.2.6), disaster response (1.2.8) and pH evaluation of new acquisitions (1.3.3). Priorities for interventive conservation are iron gall ink corrosion (1.2.3) and cellulose acetate degradation (1.2.4), although our perceptions of the relative importance of the risks may change as a result of the assessment.

2. Partnerships

Most of the problems identified in the preceding section affect all libraries and archives, and some, like acidic paper, are so universal that they can only be tackled economically on a national or international basis. Other problems affect so many different areas that it would be impossible for one institution to tackle them on its own. Such subjects are most effectively addressed by teams of people from different institutions working in partnership, with each partner bringing their own skills and knowledge to bear on different aspects. By sharing resources, even limited funding will go further and deliver more. We will therefore develop partnerships with appropriate organisations, wherever possible, in order to carry forward our own research objectives.

Nevertheless, there will be circumstances, such as the early phases of projects, where initial developmental funding may have to come exclusively from the Library's own resources.

Other libraries in the UK look to the British Library to provide leadership in conservation research, and several have expressed interest in forming a research consortium. By sharing resources and equipment this would avoid duplication of effort in areas such as the testing of materials for quality assurance, developing common specifications and developing appropriate test methods for library materials. We will take this forward by investigating the most cost-effective means of supplying these services.

Some problems will be most effectively tackled at the national level, others at the European or global level. At the national level, we will seek to involve end-user partners who, like ourselves, have a practical interest in applying the outcomes of the research. These include bodies such as the National Archives, the National Library of Scotland and the National Archives of Scotland. We may also involve partners who have a specific interest in the materials we use, such as the Leather Conservation Centre or the Textiles and Paper Department at Manchester. At the European level, we will seek to work with partners who are already active in areas of interest to ourselves and who have a reputation for producing results, such as the Royal Library of the Netherlands, the Netherlands Institute for Cultural Heritage or the National and University Library of Slovenia. On the global scale, we will seek to work with partners who have the resources and breadth of interest to work on the most challenging and large-scale problems, such as the Library of Congress, the Image Permanence Institute and the Canadian Conservation Institute.

Since the British Library is effectively a new entrant into the field of conservation research it will take time to build up our own research capability. We will identify the most appropriate level for each collaboration, and where possible we will seek to join existing groups. This will enable us to participate meaningfully while building our own expertise. We will endeavour to obtain funding for projects from research councils, grant-giving bodies and the European Union, recognising the need to balance the effort involved in applying and the risk of not succeeding against the rewards of success.

We will convene an international meeting of national library and research institute representatives, to try to set a wider agenda for conservation research in the library and archive sector. This will explore the possibilities of developing collaborative applied research programmes which are specifically focussed on the needs of libraries and archives.

3. The Web

The British Library is committed to making more of its holdings available via the Web, both for the convenience of users and to reduce handling and risk of damage to vulnerable items. We will investigate methods of minimising damage to objects during digitising and scanning.

We will work in conjunction with the National Preservation Office to ensure that more conservation and technical information, of use to professionals and the public, is made available on our website.

CONCLUSION

In all we do we will seek to obtain value for money and maximise successful outcomes. Where possible we will build on existing research undertaken by the Library, and we will prioritise our efforts by mapping research proposals against the needs identified here. Although the majority of our work will be oriented towards practical goals, we do think it is appropriate to dedicate a small percentage of our time to projects that do not have an immediately obvious practical benefit, but which have the potential to lead to worthwhile future applications.

TABLE 1 CONSERVATION RESEARCH PROJECTS UNDERTAKEN BY THE BRITISH LIBRARY SINCE 1990

Project title	Person / place	Date completed	Outcomes	Comments
Paper strengthening by graft copolymerisation	Alan Millington / Christine Butler, University of Surrey, + BL	1991	A successful process was developed, but it was not commercialised	This was the only viable process that strengthened paper. One problem was residual odour of monomer. It would be worth investigating whether this could be overcome. Requires publication in professional literature
Ancient colorants and dyes	Prof Ken Seddon, Dr Peter Gibbs, Queen's University, Belfast	1998	Identification of the yellow colour in ancient Chinese paper	Published in <i>Studies in Conservation Science</i> , 2
The pH microprobe	Alan Kennedy, QUB (PhD supervisor Prof Ken Seddon)	1999	Successful proof of principle	Would require extensive development to become a sufficiently rugged, commercially viable instrument
Thermal effects of scanners on photographs	Mark Browne, BL (part of the EU-funded SEPIA project)	2001	No adverse effects demonstrated	See: www.knaw.nl/ecpa/sepia/workinggroups/wp4/scanningequipment.pdf
Development of archival quality leather	Shad Mehmet, BL (part of the EU-funded BRITE-EURAM III CRAFT programme)	2001	Commercially available product produced	See: www.hewit.com/sd12-leat.htm
Anoxic storage and pest control	David Jacobs, BL	Ongoing	Storage in a low-oxygen environment has been shown to decrease the rate of yellowing of poor quality paper	In collaboration with Natural History Museum, British Museum, Tate
Raman microscopy	Prof Robin Clark, UCL + David Jacobs, BL	Ongoing	Many inorganic pigments identified on manuscripts	A review of this work, to be edited by Prof Clark, will be published in <i>Studies in Conservation Science</i>

TABLE 2 PROVISIONAL TIMETABLE FOR RESEARCH PROJECTS

Partners ▶ Time scale ▼	BL Collection Care	BL Scholarship & Collections	External
Short term (during FY 2004/05)	Iron gall ink treatment Leafcasting Alternatives to lamination Projects resulting from the Treatment Review. Will be undertaken by Conservation staff, will involve critical evaluation of options and will produce practical recommendations for methods of working.	Risk assessment for all collections Will examine critically and estimate the relative magnitude of the different risks to the long-term survival of different parts of the BL's collections. Will make specific recommendations for the management of risk for different collections. Extended survey of pH of new acquisitions To obtain a more accurate estimate of the proportion of new acquisitions (purchased monographs and serials) on acid-free paper, and the extent of any alkaline reserve. Will inform decision-making on desirability of mass deacidification at point of acquisition. Survey of pH of newspapers To assess acidity of incoming newspapers and to estimate the rate of decrease of pH. Will inform decision-making on mass deacidification. Develop scientific examination techniques to support projects such as Codex Sinaiticus. In collaboration with curatorial staff, develop techniques for the examination and analysis of library materials using visible, infra-red and ultra-violet light, in order to enhance art historical and technical knowledge.	Agreement on research consortium In collaboration with the Legal Deposit Libraries and National Archives in the UK and Ireland, to agree on a framework for standard-setting, and procurement of testing and analysis of common conservation materials. October 2004 Agreement on international conservation research agenda for paper-based library and archive materials In collaboration with international conservation research leaders, develop international conservation research agenda for the next 5 – 10 years. December 2004
Medium term (FY 2005/06 to 2008/09)	Stability of new materials and digital information carriers Will monitor degradation of new materials used in books, and digital media. Will produce recommendations for storage and treatment of these materials. Possible collaboration with The National Archives.	Assessment of cellulose acetate microfilm To assess the issues relating to the preservation and storage of cellulose acetate microfilm. Will produce detailed recommendations for the management of this material. Assessment of practical problems surrounding mass deacidification While PaperTreat will examine the technical performance of different treatment methods, this project will examine the practical implications for the BL of undertaking mass deacidification: financial, logistical, legal etc.	Drying water-damaged books Project led by Univ of Utah, funded by US National Center for Preservation Technology and Training. Will improve our own disaster response capability and enable us to give authoritative advice to others. Commences September 2004, ends August 2005 Evaluation of mass deacidification treatments (PaperTreat) Project led by the National Library of Slovenia, funded by the EU. Will monitor long-term efficacy of existing mass deacidification treatments. Commences 2005, ends 2008 Developing NIR tool for assessing paper degradation (SurveNIR) Project led by the Univ of Ljubljana, funded by the EU. Will develop instrument to quantify volatile substances produced by degrading paper. Commences 2005, ends 2008
Long term (FY 2008/09 onwards)	Real-time study of paper ageing Will monitor gradual changes in paper properties under normal storage conditions. Will produce realistic lifecycle estimates and recommendations for future storage conditions.		Externally-funded research programmes flowing from global research agenda

Appendix 5

A Preservation Research, Development and Implementation Plan for the National Archives, 2004-2007

1 INTRODUCTION

1.1 This paper outlines the strategy for conservation research and development for The National Archives (TNA) to 2007. It has been developed in view of the organisational aims, which are to:

- assist and promote the study of the past through the public records and other archives in order to inform the present and the future;
- act as a chief source of authoritative advice and guidance on records management and archive policy to government departments;
- preserve traditional and electronic records.

1.2 To support these key organisational objectives, the activities of TNA are currently focused on the enhancement of electronic access, improvements to the selection and management of records and an on-going commitment to the preservation of traditional and electronic records.

2 CONSERVATION RESEARCH, WHAT IS IT, WHY DO WE NEED IT AT THE NATIONAL ARCHIVES?

2.1 Conservation research and development is central to the activities of a fully established Preservation Service. The interpretation and dissemination of technological and scientific findings should be at the heart of preservation and conservation activities as a bridge of communication between disciplines. Integration of technological innovation, the application of convergent knowledge, skills and expertise from conservation professionals and allied disciplines, enables innovation and revision of current theories and practice.

2.2 The newly created Conservation Research and Development Section at The National Archives is timely, given the absence of a formalised research function within TNA. This creates a new opportunity to inform decision-making at all levels of organisational activity, from the treatment of individual objects to

policy-making. On a national level we are in a prime position to take the lead in areas that support the conservation research agenda for libraries and archives in the UK and Ireland agreed in 2004.

3 VISION

3.1 Our aim is to establish conservation research at TNA as a nationally recognised centre of integrated expertise based on basic and applied research and development projects to support the strategic aims of the organisation, the preservation requirements of TNA and the wider professional community.

3.2 TNA's research and development strategy will be:

- **Predictive**
All research projects will aim to further an understanding of archival records chemically and physically to assist in understanding their long-term stability. In turn, this will enable better prediction of preservation problems, and ultimately to assess the efficacy of preservation policy and practice.
- **Inter-disciplinary**
We will routinely consider the work of other disciplines such as mechanical engineering, art history, materials science, etc. to enable convergence of expertise to assist the work of the conservators and the Preservation Department.
- **Interpretative**
Particular attention will be given to the interpretation and dissemination of existing research and technological innovation in areas that will provide practical dividends and inform decision-making at all levels.
- **Collaborative**
We will actively pursue partnerships and work with other national and international bodies where TNA's strategic aims can be advanced and research gaps can be filled.

4 CONTEXT

4.1 The research programme for TNA to 2007 will support the work of the conservation and preservation service as defined by organisational objectives, as well as taking forward the national conservation research strategy for archive and library collections.

The three-year research strategy will develop research projects to support three areas of National Archives activity. These are:

4.2 Extending access to collections

Sustaining the collection for permanent retention, while at the same time enhancing access is a complex and often conflicting equation. Given the unpredicted stability of some records and the ill-defined value of the original in relation to reformatting and conservation treatment policy, this is not surprising. Within this matrix of sometimes conflicting objectives, we aim to support responsible stewardship of the collection.

4.3 Enhanced advisory role

The National Archives is well positioned to enhance its advisory role internally and externally by interpreting and disseminating the results of conservation research to the wider professional community. Our imperative is to extend access to conservation science and research through innovative and effective means.

4.4 Preservation of the records

To enable us to predict the long-term stability of our holdings it is necessary to fully understand the materials used to create records, the degradation process and the steps required to minimise them. We also need to know more about the relationship of materials to the environment in which they are kept, stored and handled. In view of this, our work will focus on developing a comprehensive understanding of the materials in TNA's collections. This will be achieved through technical studies and dedicated research projects under the auspices of the Centre of Archive Conservation Research. The work of the Centre will initially be focused in the areas of:

4.5 Technical and Analytical Studies

■ Modern materials

Increasingly records are made from modern materials such as plastics and synthetics, digital printing technologies, and a variety of fibre finishes. We need to understand the long-term stability of the records to put in place appropriate preservation policies. The preservation of modern archival records has not been fully investigated. We aim to take the lead in synthesising existing research and supporting further investigations in this area.

■ Digital Records

Will continue to carry out systematic research into new types of electronic records and develop new processes

for migrating digital data. We will continue our work on file format identification, and will continue to actively develop standards for the preservation of digital records.

■ Parchment Records

Documents made of skin represent a large proportion of records held in TNA and are the largest holdings of this kind in the UK. Current conservation treatment and preservation practice is not always based on a clear understanding of the stability of the material, the factors affecting deterioration and the rates of decay of some of the most intrinsically important material in the collection. We will therefore build on existing work, and, where appropriate, commission research to understand better the deterioration mechanisms of parchment, in order to inform conservation treatment decisions and preservation policy.

4.6 Materials Testing

The materials used to conserve, house, display, and store archive collections can affect the stability of the record. We will pursue a rigorous materials testing regime and make the results of this known to the wider professional community.

4.7 Technical Examination and Documentation

Technical history is the result of technical examination and can shed light on how the objects were used, received and interpreted. Technical examination can reveal much about how records were made, which adds to the understanding of how an object is interpreted. The conservation section will be supported in the on-going examination of intrinsically important material in the collection, through analysis and technical support, encouraging materials testing and technical examination, dedicated study and documentation.

5 SUMMARY

TNA's research programme will inform the policies and procedures of the Preservation Service through a dedicated research strategy aimed at predicting the long-term stability of The National Archives' collection. This work, where possible, will be collaborative with a primary aim of delivering practical outcomes to better understand how to sustain the UK's archival heritage and will take forward the National Conservation Research agenda. As a first step, we will build a body of knowledge on the stability of TNA's holdings through the interpretation of current literature, and the technical study of materials past and present using scientific methods and analytical techniques. We will exploit opportunities to develop new tools, methods, and materials to improve treatments.

The work of the Research and Development Section will be achieved within the three elements of TNA's strategic plan. These are:

■ Enhance access

Sustaining The National Archives, while at the same time enhancing access will be achieved through balanced and responsible stewardship based on evidence-based decision-making.

■ Extend our advisory role

The National Archives is positioned to take a leadership role to the wider public and professional community. We will make available through published and electronic and web resources, the synthesis of conservation research and technical expertise.

■ Continue to preserve the records

The conservation research strategy will improve the standard of preservation by undertaking research that will support the work of the conservation and preservation service as well as informing policy and treatment.

6 IMPLEMENTATION PLAN

This implementation plan sets out the main activities of the recently-created Conservation Research and Development Section for 2004-07.

Main Activities 2004

- Identify the long-term research needs of the Preservation Department.
- Identify potential project partnerships and collaborators.
- Detail the resource requirement.
- Exploit outside funding sources where possible.

Main Activities for 2005/06

- Advance key research projects and associated funding options.
- Establish a Conservation Research Fellowship in conjunction with Oxford Conservation Consortium.
- Advance the UK conservation research agenda.
- Support internal research initiatives.
- Appoint a conservation research advisory board.
- Support a Research Fellowship with Cardiff University and National Archives of Scotland.
- Launch the online materials data base.
- Launch of PRONOM 4, the latest phase in the development of the File Format Registry.
- Advance collaborative Joint Information Services Committee (JISC) funded projects: PRESERVE, Digital Assessment Tool, OAI-METS.
- Communicate the results of our work to our internal and external stakeholders.

Main Activities for 2006/07

- Advance of key research projects both internally and nationally.
- Support Research Fellowship with Cardiff University and National Archives of Scotland.
- Support internal research initiatives.
- Communicate the results of our work to our internal and external stakeholders.

7 PROJECTS CURRENTLY UNDERWAY IN THE PRESERVATION DEPARTMENT

Project: Technical Examination and Documentation of Intrinsically Important Records
Technical examination can illuminate questions of

how objects were used, received and interpreted. The research section will continue to support the work of conservators by encouraging investigation and analysis through materials testing, technical examination, dedicated study and documentation.
Outcome: Technical examination will lead to better conservation treatments and improved historical interpretation of intrinsically important material.

Project: Developing an online database of materials commonly used in the treatment of book and paper conservation.

Outcome: The long-term aim is to establish the database as a web-based tool to serve the wider professional community.

Project: Improved Damage Assessment of Parchment (IDAP - EU funded project)

As an end user of the Damage Assessment Package, we will be looking at around twenty 16th century items that have been repaired in a variety of ways. This assessment may help to determine different states of deterioration, for example, between the original and repaired samples.

Outcome: To develop in-house visual and analytical expertise; to assess the deterioration state of a sample of TNA's collection; to build a working relationship with other European partners.

Project: Modern Architectural Drawings: 1970 – present

This project aims to document architectural drawings written on plastic supports from 1970 to the present. We will investigate the long-term stability of the supports and media used to create these archival records.

Outcome: Revision of current preservation policy on the conservation and storage of these materials in light of findings.

Project: Retrospective and Prospective analysis of Heat-set Tissues and their Application within TNA
This project seeks to evaluate the current use of heat-set tissues and to investigate the reversibility of past methods.
Outcome: Recommendations for revised practice will be made in light of the conclusions. This work will be disseminated widely.

Digital Preservation

Project: PRONOM 4 File Format Registry
This project will enable the development of methodology for automatically extracting file format signatures; development of methodology for automatically identifying digital object formats based on signatures and the creation of a file format specification documentation reference library.
Outcome: This tool will be used to differentiate file formats and supply specifications that can be later used to prevent formats from becoming obsolete.

Project: Software testing

This project will evaluate web crawling software; evaluate PANDAS software (in conjunction with UK Web Archiving Consortium) and evaluate digital repository software.

Outcomes: PANDAS software will be used to harvest websites for the Web Archive. The results of this work will report repository

software evaluation to Seamless Flow Preservation project.

Project: Web Archiving

Development of methodology for harvesting intranets

Outcome: Use PANDAS software to harvest intranets and document results on achievements.

Project: Preservation and presentation Identification of web presentation and preservation formats

Development of additional advice to other Government Departments on format issues; evaluation of migration pathways

Development of a multiple manifestations data model to support migration-based preservation.

Outcome: To identify web presentation techniques and preservation formats to avoid formats becoming obsolete

Project: Repository Certification

Based on the Research Libraries Group work – for TNA and Places of Deposit (PoDs) for Public Records:

- Development of additional advice to Places of Deposit on setting up Digital Archives – e.g. TNA evaluation of digital repository software
- Evaluation and approval of PoDs against possible ISO standard

Discussions held with Seamus Ross, Electronic Resource Preservation and Network, (ERPANET) and David Corney, Rutherford Appleton Laboratory (RAL)

Outcome: Report developed inspection report for digital places of deposit and begin implementing this to wide certification.

Project: Development Digital Preservation related International Standards

- ISO 19005: PDF/A ;ISO 15489: Records Management; ISO Technical Committee TC 215, Working Group 4 for 'Information Security, Safety and Quality' standard on the 'Security Requirements for Archiving of Health Records'

Outcome: Resolve as an ISO standard format

Collaborative projects

Project: PRESERV

JISC-funded project to develop an ingest module for the Eprints digital repository software, including integration of PRONOM services.

The project will last for two years, from Nov 2004, and is led by Southampton University, in collaboration with TNA, The British Library, and Oxford University.

Outcomes: To:

- adapt Eprints software to allow the collection and dissemination of preservation-oriented metadata to supplement the current bibliographic information.
- develop and host a Web service and/or downloadable software for file format recognition based on PRONOM software
- integrate (1 & 2, i.e. implementing an OAI ingest service for the Eprints archives) into the Eprints deposit process for two existing institutional archives, at Southampton and Oxford Universities, to evaluate this service, subject to satisfactory testing on pilot archives

- build and test an exemplar OAI-based preservation
- define a technology watch service to populate and update PRONOM for file format recognition and verification, identifying the needs of different sectors.

Project: Digital Asset Assessment Tool

A JISC-funded project to develop a digital preservation assessment tool, based on the National Preservation Office's PAS toolkit. An 18-month project led by the Arts and Humanities Data Service (AHDS) and University of London, in collaboration with TNA, The British Library, Loughborough University, and Kings College London.

Outcome: A Digital Asset Assessment Tool, hosted on the web, with helpdesk and support service provided by the AHDS. The tool will be targeted at the needs of the UK HE, FE and research sectors, but capable of deployment in other sectors such as national libraries, archives and museums and government.

Project: OAI-METS

JISC-funded project to map the OAI reference model and METS metadata standard to the repository systems developed by TNA and the UK Data Archive. The project will last for 6 months, from Nov 2004, and is led by Essex University, in collaboration with?

Outcome: The results will be presented as a report on the findings.