AUDIO VISUAL STANDARDS AND BEYOND

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Preservation Reformatting???
Audio Visual Standards and Beyond

I doubt the efficacy of REFORMATTING to preserve audio and video, hence the question marks. I am going to raise some questions, and suggest a different Archival System Architecture Scenario to truly preserve audio and video for the long-term.

- John W. Carlin, Archivist of the United States, in NARAs Vision Statement writes:
    - "To be effective, we at NARA must:
        - Find technologies, techniques, and partners worldwide that can help improve service and hold down cost.
    - And about Risk-taking:
        - Experiment, take chances, try new ways, learn from mistakes, be open to change."

We can therefore establish new rules and best practices for specific applications that we care about or that would facilitate our ability to provide needed services.

Should Standards Force Uniformity and Status-Quo?

In the past, the time-span of important change was considerably longer than that of a single human life (i.e. film). Today, the time-span to change is considerably shorter and change continues to accelerate (i.e. video).

Alfred North Whitehead in 1942 observed that:

- 'In the past, the time-span of important change was considerably longer than that of a single human life.
- Today, the time-span (between changes) is considerably shorter... it has continued to accelerate.'

Jonathan Sacks wrote recently:

- 'What is specific to our present situation is the sense that change is running ahead of our ability to chart a course for a shared future.'
- In a dynamic industry as ours this challenge resonates loudly whenever we meet!

Should Standards Force Uniformity and Status-Quo?

Standards cannot and should not be used to freeze the design of systems, unless a system must be enduring.

Rapid system change, while providing diversity, must be modulated by the interests of all stakeholders, not just by some of them. Yet we frequently encounter a mentality that prefers the comforts and certainties offered by the status-quo. It is not the purpose of standards to slow the diversity or pace of technology change.

Our level of frustration with the absence of adequate coping mechanisms can be reduced in various other ways. For instance, consider the potential of innovations, consultations, alliances, scenarios for experimentation, benchmarking of sound principles and best practices that enable us to manage change.

Some solutions are created through standards work. Companies, industry organizations or government agencies with an innovation-friendly mentality, or who participate in standards work, avoid the nightmare of unresolved issues or unanalyzed problems, or the frustrations of the non-initiated, and unheard voices.

I hope that my remarks empower you to make a difference.

STANDARDS:
are motivated by commerce and are application-specific.

Many are wrestling with rapidly evolving and fleeting digital technology that does not meet the need for enduring archival applications.

Enduring archival applications may have to be do-able, survivable, affordable and effective now and 1,000 years from now.

I gratefully note, that many have nibbled around the edges of the problem (some admirable nice 'bites'), but propose the development of an Enduring Archival Backup Architecture that meets the need and creates a new service industry that enables long-lived electronic productions.

Some years ago, the archives of the European Broadcasting Union (EBU) member countries also faced the challenge of the short-lived multiplicity of video news recordings and decided to act on it.

TV production specialists, archivists, manufacturers, developers and integrators engaged in a dialog and the resulting digital asset management reference systems for TV news are now seen at every industry exhibit around the world. They have created many opportunities for the Society for Motion Picture and Television Engineers (SMPTE) to help assure system integration.

STANDARDS:
We encounter a conflict between two frames of mind:

- TENTATIVITY, a throw-away or 'just -copy-it' attitude, and

- GENERATIVITY, which cares about enduring content suitable for future generations of consumers.

Focus should be on the **future viability** of our audio-visual works. The proponents of Digital Cinema are also engaged in the definition of solutions that will work for everyone. In the film and television production community we use TENTATIVE recording solutions with 'inexpensive immediacy' to store and transport our productions.

The price of this TENTATIVITY though requires an addiction to life support for media recordings, starting with their infancy and it ends during their adolescence after pathetic short lives, never beyond 20 year life cycles.

Our media recordings are not designed for GENERATIVITY. They barely survive for one generation, and then only sickly, as long as compromised content has not altogether faded away. Life expectancy and valuable production investments are bartered away with the consequences of short-sighted system design and production media selection decisions.

STANDARDS:

- Are time-consuming and costly to produce.
- Typically, the voice of the archivist is not heard.
- Are created by a specific group of proponents to enable them to do business and are profit-motivated.
- Do not result in all-inclusive solutions.

Writing Standards costs the participating companies and individuals considerable amounts of time, often years, and there are considerable travel expenses to justify, that must add value to marketing efforts.

Archival concerns are hardly ever on the agenda, hence committee activities of the motion picture and television engineering societies, have not heard the voices of archives and the owners of productions.

An SMPTE Standard:

"Basic specifications, dimensions, or criteria... necessary for effective interchange and/or function necessary to achieve effective interchange and/or interconnection within the system described."

Few Cinematographers, Producers, Archivists and End-Users are involved in standards processes.

Standards enable systems to function by attuning their elements to function with other elements. Hence many Standards accommodate the use of film or tape in various cameras (and laboratory equipment) or video camcorders, each made by different manufacturers.

Standards are also increasingly the means of documenting software solutions and describe and clarify the functions of encoding systems embedded in recording systems.

I have a problem.

Standards only apply until the systems die. Archiving is concerned with keeping the recordings beyond the death of the systems necessary to use them. Note that interchange and interconnection is only of concern until the system dies due to obsolescence.

Some years ago I pointed out that many users require documentation after systems cease to be marketed. Thus, it has become SMPTE policy to establish an Archival Document Classification for any obsolescent or discontinued system or aspect of a system. That benefits users whose tape collections would risk losing their value as they are not usually kept appraised by manufacturers when systems are discontinued. Manufacturers simply had not considered that 'technology refreshment' and obsolescence condemn whole collections of tape to sudden death or costly transplant operations.

Archiving is concerned with keeping the recordings beyond the death of the systems necessary to play them. The current situation actually leads to a toleration for the rapid obsolescence of older electronic productions.

I want to change that.

You have a problem.

There is a serious disconnect between the recording media and their proprietary playback technologies in archival applications.

There is an unrelenting flow of proprietary recording dialects and flavors.

Digital is no enduring archiving solution.

After years of trying, key SMPTE V16 Television Recording and Reproduction Technology Committee have accepted my notion that the interchange of recordings made on obsolescent systems should also be defined to continue beyond the death of recording systems. The response has been to create product families and to provide backward compatibility of new playback systems with earlier recording formats of the same manufacturer. That at least doubles the life cycles of older tape recordings, but does not make them as enduring as archivists need them to be.

So if we want to resolve the SHORTEVITY of recordings, we need to specify a new application for it on its own terms in such a way that it becomes an attractive proposition for everyone. We all know that large quantities and an even greater variety of recordings for which the proprietary playback equipment is no longer available, increasingly threatens the viability of video and audio collections.

When the objective is content longevity, just transferring the content of a diverse range of recordings in perpetuity to even shorter-lived digital system-reliant surrogates is no solution.

DIVERSITY is A FACT OF LIFE
An Archival Backup Application is the only Lasting Solution

I have spent the last ten years looking into the issues raised by legacy recordings. I have heard the perspective of broadcasters who 'swim in tapes.'

Diversity is a Fact of Life, so inventiveness needs to be applied to solve the problems associated with the shortevity of recording technologies. So we need to formulate an application-specific solution for perpetual audio visual records on archival terms.

It can be done. And the place where the legacy problem is averted is during post-production when productions are new, and not in archives when the materials are already ancient history.

Archives get the wrong film media to preserve:

- Short dye-life color prints.
- Film printing elements that are worn.
- Originals made on triacetate film are subject to vinegar de-acetylation as well as color dye fading.
- Video masters in low-quality, short-lived, esoteric or compressed formats are based on systems that last 10-20 years.
- Digital data media need replacing every 5 years (max) due to rapid system evolution.

During the last few decades, archives operated by the owners of productions, i.e. film studios and broadcast archives protect their future intellectual property (or intellectual property with a future). They wisely safeguard opportunities for new revenue-generation by lengthening content life. They can confidently reissue or re-broadcast their productions, or sell stock-shots of unused materials.

To enable this, they create surrogate archival film elements and surrogate video masters not only for broadcasting, duplicating, replication or streaming, but also for long-term storage, exploitation and reuse in the same or developing markets for new generations of viewers.

The exploitability of their assets is best assured by using enduring solutions and low maintenance cost, hence most prime time television programming surrogates continue to be based on motion picture film materials.

Sadly, public archives whose services are typically of interest once a production or distribution company dies or when copyrights expire, end up with some of the worst artifacts imaginable, when you consider that extended-term Archival Records must last or they will certainly perish.

Perpetual crisis management of sickly media and content does not make them endure. Old folks do not live longer by giving them fresh air and fluffy pillows in old folks homes, it is their lifestyle choices long before that assure longevity.

Archives get the wrong electronic data media to preserve audio-visual works and have to commit to very high maintenance budgets without a chance to recover such investments out of revenues.

Archives get saddled with the consequences of choices made when media are designed and productions are made. They are expected to make lasting Archival Records (or silk purses out of 'sows ears') out of fleeting recording systems, analog and digital, without a chance of success. And investing millions of tax dollars in inappropriate, tentative and barely functional 'digital' technology 'solutions' is no solution.

Meanwhile, the owners of film productions would not think of using digital technology, other than to facilitate the short-term exploitation of their productions with 'digital intermediates' which are exploitation surrogates. But electronic storage systems have not yet been developed for extended-term content preservation purposes.

A NEW BACKUP SERVICE:
A Success Strategy

1. All digital library "solutions" come with unavoidably high maintenance costs.
2. Archival back-ups should be made when the production is new.
3. Low maintenance media must be used.
4. No more worn, low quality elements.
5. No more vinegar risks with Archival Backups.
6. No more color-dye fading.
7. All materials offered to Archives must meet Archival Backup Standards to be preserved with their full integrity assured.
8. Do not accept the mixing up of Access and Archiving with the same recording.

We have learned what not to choose for a lasting Archival Backup.

- Create no more vinegar risks with triacetate media which is unavoidable when storing original film materials.
- Avoid color dye fading.
- Do not use media which requires unproven adhesives or that require rubbing contact to be replayed.
- Do not use media that are vulnerable to damage in transports, such as very thin tape.

The best time to make a lasting Archival Record, I refer to it as a Backup, is right after you finish making and approving the production. Archival Backups are not just made when restoring production elements, although they should be made before they cannot be restored anymore. It should be easy to assess when degradation occurs.Reference data that describes what it was approved to look and sound like must be included with the backup.

Archives must specify what constitutes sustainable and affordable and enduring Archival Backups for audio-visual works. Archivists should separate those applications and solutions needed to provide Access from those needed for enduring Archiving.

We are talking about different kinds of surrogates, one to preserve content integrity in the extended-term, and the other to enable content to live in diverse applications. The only thing that these surrogates used have in common between Access and Archiving applications, is that the words describing them start with the same letter 'A', that's all.

LIMIT THE DIVERSITY:
Audio-Visual Archives Need a Success Strategy

You will be asked to compromise the content integrity of what you need to preserve for Speed Greed and Capacity Audacity. You save millions by avoiding Mystical Digital "solutions."

Remember these words that describe buzzwords, left-overs from the bankrupt dot.com mentality that are used to dazzle your community:

- Speed Greed - ever faster transfer speeds.
- Capacity Audacity - getting more on less media space.

For the sake of progress, you must replace your entire collection every few years at enormous maintenance costs and risks. Mystical Digital remains under development and usually forces obsolescence for specific technologies and automatically eats up budgets without providing lasting value.

A NEW BACKUP SERVICE:

For years Video Applications have aspired to look like Film. Film is widely used to create Video Productions. Film is not used to PRESERVE Video Productions. Video is used because it is considered to be cheaper than shooting on film in the short-term.

But many productions for TV are shot on film if they are to be used internationally and for enduring exploitation. Film easily accommodates every level of video quality, and it is far more suitable for extended-term preservation.

The way Video media evolved, few would seriously consider transferring such cheap productions to film. Today, with video picture quality even suitable for projection, it is time to secure those production investments using the most appropriate solution for that purpose. Only their transfer to film assures extended-term life cycles.

Why not?

APPLICATION SPECIFIC:
Make Archival Back-ups when Productions are New

Production Companies should allocate the budget needed to make enduring Archival Backups to protect the production investments they make. Waiting to take action to preserve a production when it is old and worn makes no sense at all.

Archives, unless owned by studios or broadcasters who can recover their investments, are the last place where budgets can be found or justified to copy collections more than once. So let's define what functionality we should expect from a one-time and enduring Archival Backup System.

A NEW BACKUP SERVICE

To Preserve and Perpetuate requires:

- Constant integrity of the support medium.
- Constant integrity of the recording signals.
- Perpetual ability to read and decode.
- Sustainable and affordable maintenance.
- Compatibility with a constant, known and readable reference

Some Key Objectives.

- Constant media integrity.
- Constant signal integrity.
- A perpetual ability to read and decode the archival record.

Of particular significance is the last point - an archive must have a constant, known and readable reference. Without it, an archive does not have a lasting Archival Backup, regardless of how many tapes it has on the shelves.

THE BATTLE OF LECHFELD

In the year 955, German emperor Otto I and Ernst, count of Sualafeld in Bavaria fought a decisive battle over the Magyars. It established the dominance of the Bavarians (Boivarii) over what was to become Austria (Ostarrichi). An eyewitness visualized then what he saw. How well would it have lasted if it were digital?

Let's illustrate what an enduring Archival Record is. Note that we are talking about something that happened in the year 955, or 1048 years, or 42 human generations ago. Someone had an enduring Archival Record in mind, and I am glad he/she did.

THE BATTLE OF LECHFELD

Try and imagine how hard it would have been to preserve this by means of a digital surrogate:

- through the evolution of recording technologies every ten years or 105 migrations away from the original record,
- across at least 52 total changes in encoding technology, or every 25 years!

How did we get such a good picture?

- The original was preserved in human readable form and is easily viewed.
- It was not or was minimally exposed to or remained unaffected by light, pollutants, water and humidity.
- The enabling technologies were chosen to last.
- Its metadata tells us what it represents.
- It required minimal resources to be preserved.
- Compression was not considered.
- Its viewing was not based on a proprietary solution.

It is not a secret why this survived so well, even without wrinkles.

- An original in human readable form.
- An enduring medium and encoding system.
- An enduring description of what it depicts.
- Its readable metadata describes what it must look like.

Our recording media do not last a century. It's time we solved this problem.

In 955, the maintenance budgets were minimal. All of the content was preserved, not just 10% or less of it. Viewing it is possible for everyone equipped with simple lenses. The recording system was designed to last, in other words not subject to redundancy caused by product life cycles.

If they managed the problem of enduring records in the year 955, so with all our sophistication and smarts, can we! It's about time!

INAPPROPRIATE SOLUTIONS FOR ARCHIVING

Perpetual Migration-It Is An Option From Hell!

Making useless transfers from one flavor encoding and storage system, be it digital today, or analog yesterday and whatever encoding methods still await us, is illogical, wasteful of resources, and risky behavior as it is sure to put the essential data fidelity of the approved content at risk.

Nothing against digital managment?

- Fine for local and distance access.
- Excellent but costly dispensing machines suitable for Data Warehousing.
- Lack system longevity and technology durability.

Perpetual migration across systems is a nightmare, bad for the environment and for your budgets. Data Tape cartridges are one 'solution', followed by 'Redundant Arrays of Inexpensive hard disk Drives' (RAID) or Virtual Online Serial Network Attached Storage (VOSNAS) and even 'jukeboxes of DVD optical compact discs'.

There are a variety of proprietary systems that come and go, creativity has few bounds. Used as recommended, you will be swimming in more media amidst unsustainable mountains of waste. We use non-replaceable raw materials to make temporary media and do not recycle them and that cannot continue forever. And none of them are capable of meeting extended-term life archiving needs beyond one or two decades.

Digital recording technologies are:

- Youthfully dynamic, run on vaporware.
- Perpetually unfinished and short-lived.

- Works in progress that remain under development.
- Moving targets with no long-term benefits.
- Are impossible to capture with lasting open standards

As fluid as today's digital systems are, 'enduring' is the last word that comes to mind. Their rapid evolution means that standards cannot be documented fast enough, unless they are 'de facto' standards.

Many stakeholders are also reluctant to disclose their hard-earned trade secrets through the standards process. Huge investments and short recovery times require them to keep competitors at bay instead of educating them. Rather than showing their cards at the Standards Committee table, some large stakeholders would rather listen, sell systems quickly and submit 'de facto' systems to Standards Committees. Such standards are often the preferred way to go for systems that require a significant investment to be developed.

INAPPROPRIATE SOLUTIONS

- Digital recording is a half-solution and Trojan horse in your archives.
- Digital signals are destructible.
- Technology evolution makes collections obsolescent faster.
- Migration of content over and over again to preserve it is not sustainable.

Abby Smith, Director of Programs at the Council on Library and Information Resources, of Washington, D.C, stated it thus: "The layman's view is that digital information is more secure, when in fact it is more ephemeral. We know how to keep paper intact for hundreds of years. But digital information is all in code. Without access to that code, it's lost." (Claire Tristram about Data Extinction in the MIT Technology Review, October 2002, p.38).

Claire Tristram in Data Extinction, MIT Technology Review, Oct. 2003, p.40, called Migration- "Digital Transplant Operations." The risk with periodic conversion of digital data to next-generation formats she summarized thus: "Copies degrade from generation to generation."

In 1048 years, we are talking about 105 migration cycles, across 52 total encoding system changes. Along the way, goodbye to all your sickly first generation artifacts and investments in lossy surrogates!

Avoid recording products based on a 'fresh until consumed' design philosophy. Search out and demand systems based on a 'fresh for life' design philosophy. Avoid recording technology based on proprietary dead-end dialects that do not permit perpetuation with integrity.

Ecology of Commerce author Paul Hawken described our Industrial Age mentality about the use of natural resources, which applies to media use in our industry as well, as: Take-Make-Waste. It is the opposite to 'biomimicry' described by Peter M. Senge and Goran Carstedt as innovation inspired by our understanding of how living systems work, i.e. Produce- Recycle-

Regenerate. Throw-away surrogate solutions for archiving applications are non-starters for archives.

A VISIONARY SCENARIO:
Create a Perpetual Archival Backup

Consider my enduring Archival Record System Architecture Scenario, it is one high-level vision.

There are an array of candidate technologies that can serve as the basis for a truly enduring Archival Backup for any electronic media content created now and into the future.

I invite you to bring your representatives to the table to consider the functionalities required. I will bring the experts to the table who we need to formulate the required system elements and technologies and their performance levels, and to

Develop prototypes that create a new Archival Backup industry for electronically recorded audio-visual content. Finally, with the proponents, we will take our 'de facto' standards to ISO, with the support of SMPTE, to assure that such records will always remain functional.

Support Media System

Avoid systems based on the 'take-make-waste' design philosophy.

Avoid recording media designed for auto self-destruction.

Avoid maintenance based on complex arrays of coping mechanisms, to compensate for design and manufacturing failures

Here is a short list of requirements:

- A system designed to last.
- Self-destruction is unacceptable.
- Inadequate design and manufacture for redundancy and obsolescence and limited life cycles is unacceptable.
- The media used will have to be fresh-for-life instead of fresh-until-used.

Encourage and Support:

- Self-correcting and self-calibrating media.
- Use polyester-based panchromatic black and white film technology for a black and white print back-up.
- Record the color rendering, sound and metadata on high resolution B&W polyester film.

Several candidate technologies:

- Smart media (with embedded metadata) that maintain the agreed upon initial quality characteristics.
- Robust Polyester film.
- Black and white silver emulsion.
- Color rendering metadata also recorded on polyester high resolution black and white silver emulsion film.
- Etched data on DVD media, such as a glass master created for replication or a nickel stamper used for disc replication, provided that the system is supported to last, i.e. glass or polycarbonate media etc. may be used for multimedia content.

For enduring archival applications, system design can be and must be frozen. Innovations dictated to perpetuate temporary recording solutions is undesirable and unacceptable.

BEYOND STANDARDS
Set your priorities

Because new applications innovation first arises in our minds, it is highly important that our attitude is 'open-minded.'

On this receptiveness to change, our thinking about enduring Archival Records in the language of the NARA Value statement under the heading Communication, states:

Propose ideas, dialogue with others, develop trust, and act openly, honestly, and with integrity.

So here is a beginning of our flow of ideas and dialogue.

Beyond Standards-I

- Take a long-term view.
- Manage rather than suffer change.

Those who produce and fund audio-visual works are in the best position to assure the enduring presence of their works as artifacts of our culture. Their decisions determine whether their work can withstand time amidst change.

We need scenarios that break out of the status-quo. What happens depends on our attitude and the outcome is our own creation, we should choose allies who have an investment at stake.

Those who produce audio-visual works must be at the table, for without a change in attitude, archives will not receive enduring archival backups.

The enemy of archives is not a lack of budgets, but the TENTATIVITY of the audio-visual media you accept. Temporary solutions for archiving cause a believability gap with money people when ever larger system maintenance budgets are requested. Hence scenarios that lead to

freedom out of the status-quo can be developed with confidence will be supported by the owners of new intellectual properties inherent in media productions.

Beyond Standards-II

Man's vision is largely time-limited, but the interests of mankind are perpetual and enduring. The products of culture (i.e. audio-visual works) are for consumption by both time-limited and perpetual audiences for which archivists collectively are the 'voice'. The focus of archives must be on enabling mankind to inherit their legacy of our works in usable form.

GENERATIVITY is the word to describe looking after future users. Archivists are the voices of generations of mankind not yet born and this project will register your collective voice without ambiguity.

TECHNOLOGIES ALREADY IN PLACE FOR ENDURING BACKUPS
A quick visit to some promising technologies.

Most technology is in place. Both film and electronic images are enlarged between 50,000 and 500,000 times when presented on the screen. Screen quality of film accommodates all video source materials. Source images can be backed up when new and as projected. This circumvents all other technology needed to record or play them back.

Although the context in which pictures and sound are captured is of future interest, it is not desirable for archivists in preserving such content, to be handicapped by the fleeting systems with which those pictures and sounds were captured.

Our focus should be on the end results, which are:

- STRINGS OF PICTURES and
- STREAMS OF SOUND.

Therefore, think projectors, and not cameras or sound recorders as the instruments used to access them. Capture those images and sounds in a lasting Archival Backup Record when they are new.

Other than in museums, dispense with the technologies used to generate and manipulate them when addressing how to preserve strings of pictures and streams of sound, they are irrelevant to that application.

The Optical Printer

Left: Projectors **Right: Camera**

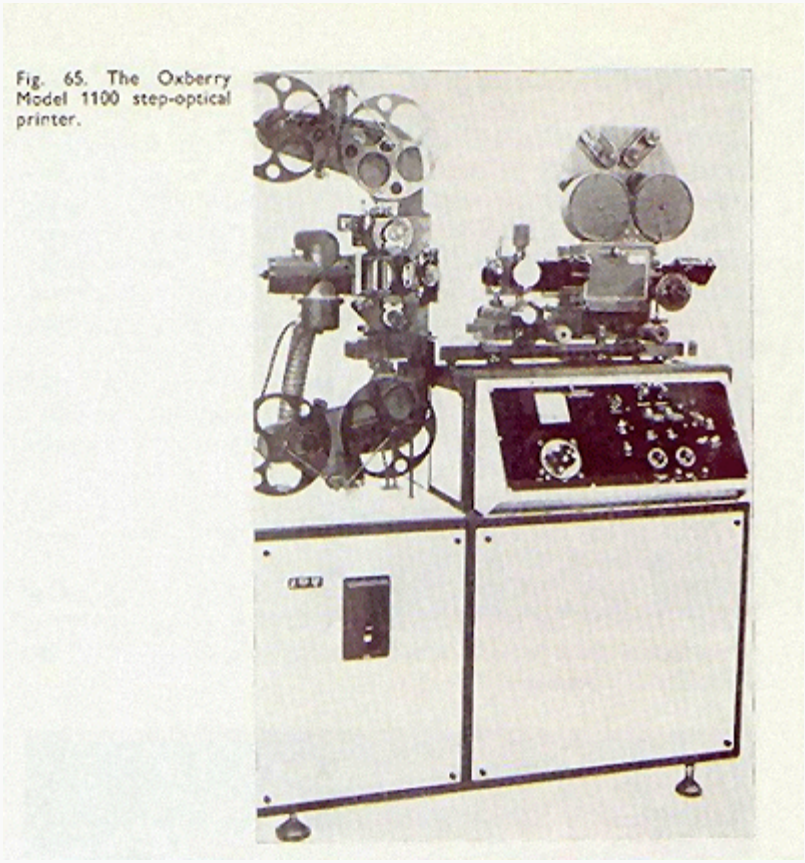

Fig. 65. The Oxberry Model 1100 step-optical printer.

This traditional optical printing machine is used to capture strings of projected pictures, regardless of how they were captured. To your left are one or more film projectors, to the right a film camera. All are situated on an optical bench to assure exact alignment and registration.

A video or data projector with its displayed pictures captured in any one of many ways can also be used to throw its strings of pictures optically onto film. We would want permanence, so we specify capture on polyester black and white film.

The color rendering, sound information and reference metadata with addresses are split off electronically to another capturing medium that is lasting in nature, such as high resolution black and white silver emulsion polyester film, or on a permanent etched optical disc.

All data can be recombined again on a similar device, to produce color pictures and sound in a useful form at the time it is required.

Multiple Projectors and Aerial-Image Insert-Lay-out

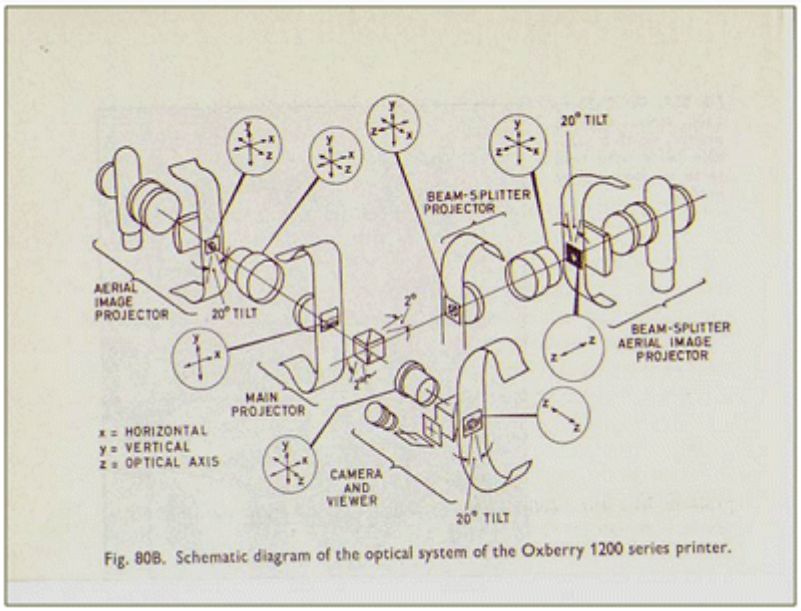

Fig. 80B. Schematic diagram of the optical system of the Oxberry 1200 series printer.

A Service Facility needs an optical bench to accept optical input from various sources, traditionally this has been limited to film source materials. That is very similar to the use of multiple projectors and aerial-image setups now used to record film from film.

But the source materials fed into this type of recording system do not have to be limited to film to film use. The system can accept any image and sound input and create effective film-based surrogates of picture strings and sound streams, that have been originated on non-film-type electronic recording systems, none of which exceed the resolution of film.

Multiple Projectors and Aerial-Image Insert-Real Life

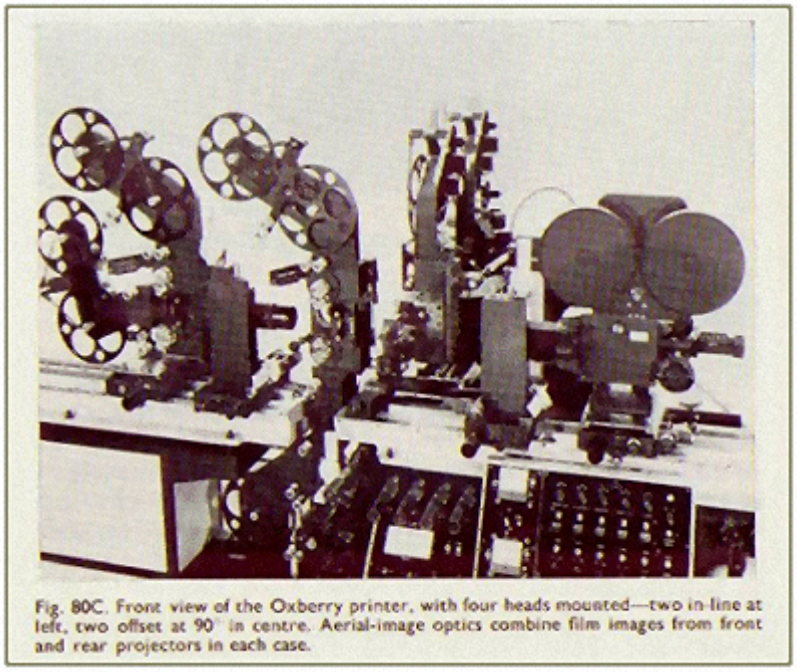

Fig. 80C. Front view of the Oxberry printer, with four heads mounted—two in-line at left, two offset at 90° in centre. Aerial-image optics combine film images from front and rear projectors in each case.

This shows a set-up with multiple projectors, the combination of their images is presented to the film camera on the right. We can replace film projectors with projectors and sound modulators used to present electronically generated pictures and sounds.

This approach, other than to create lasting Archival Backups, could also provide a much expanded lifecycle for digitally-produced cinema, documentary productions made for television and movies of the week, all of which now are threatened with very short life-cycles.

Three cameras are required to produce three pan separation YCM records, instead of one black and white print. It is the only sure system to preserve color content and can be made in a single pass. The system also requires data projector and video projector inputs.

Sound Is Also Recorded Optically

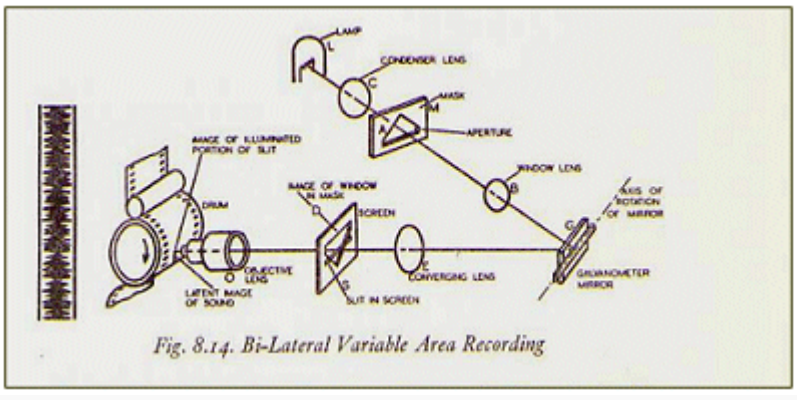

Fig. 8.14. Bi-Lateral Variable Area Recording

Sound for motion picture film is also recorded as optical information onto high resolution polyester black and white film. Of course, multiple tracks can be recorded side-by-side on

such film material, along with time code addresses and color rendering metadata and to synchronize picture and sound elements.

The sound may also be preserved on an optical glass or polymer master disc made for replication purposes, or a nickel stamper on which the signal and metadata are etched permanently.

The Justification

Projected streams of images from film, electronic media, and scanners quickly appear and disappear. Those fleeting pictures are of interest to the archivist, hence a surrogate backup is created.

It can be preserved with confidence and integrity. Images presented to projectors can also be captured optically and recorded on polyester panchromatic black and white film. The color, audio and metadata can also be recorded on a high resolution B&W film.

When addressing the permanence of archival recordings, only optical representations of pictures and sound on a surrogate for temporary originals are of interest to the archivist. Archivists know already how to preserve film elements.

When creating a lasting surrogate to preserve audio-visual works, what matters most is the making of a truthful representation of the original record. Such surrogates can be preserved as enduring Archival Backups without using the machines that were required to record or play back their short-lived originals.

Some aspects of an enduring Archival Backup Architecture:

- Image strings are recorded optically, onto Polyester panchromatic black and white silver emulsion film.
- Color rendering, audio and descriptive metadata are recorded on a high resolution polyester black and white silver emulsion film.
- For multimedia content, an etched DVD master or nickel stamper may be used, as long its system design is frozen and supported for enduring archival backup applications.

FUNCTIONAL PERFORMANCE CRITERA
A Proposed Requirements Statement for a Dedicated Application

The Functional Performance Criteria for an enduring Archival Backup are based on the input provided by the archival and post-production service communities.

The examples in this paper are possible solutions, a scenario for a system architecture that is based on our best current understanding of the requirements and possibilities of technology will outline what the system requirements and performance will be like.

Functional Performance Criteria

1. All elements must later be recombined at the projector.

2. The setup of the Backup must be self-calibrating.
3. Backups must have metada at the head or on paper, that represents essential criteria about the approved 'look' and 'sound' of the production.
4. Store image backup materials on black and white panchromatic film.
5. Store analog sound and metadata on black and white high contrast film.
6. Aerial images of any source material can be backed up.

Here are some examples of criteria that might be expected:

- The system deals with the recombining of the Archival Backup elements that have been created.
- The system must be self-calibrating and self-correcting when playing back. This will assure that the content representation will not have changed and the approved representation of both images and sound.
- The system must include essential metadata. It describes the approved color rendition, the look and sound for each production.
- The system must fully automate the creation of the Archival Backup.
- Cloning is a requirement and the system must include source ID to provide an audit trail to the source.
- The system accepts every level of image and sound quality presented as the source.
- The system accepts any source images, video, data, multimedia, audio, film pictures, photos, photocopies, scanned images, slides and digital still pictures.
- The system will accept any type of moving or still images created electronically, on tape, disc, film or any digital photographic system.
- The system can use any source that can be scanned or projected for the Archival Backup.
- The system must create an enduring Archival Backup that is identical with the source material used, no enhancement, no degradation, but it will accommodate any level of input quality.
- The Archival Backup must be reproducible to any present and future receiving medium in the short, long, or extended term.

Black and white panchromatic silver emulsion is specified as it has proven to reproduce color images with the best image quality, albeit in black and white form. Black and white high contrast film is used for sound tracks and microfilm records and is a proven technology. Aerial images enable the combination of various source images at the same time. Etched optical disc masters and nickel stampers are produced by mass replicators.

Based on the diagnostics of the system, appropriate compensation or correction is calculated to conform the output with expectations. Labor constitutes the highest cost of creating an enduring Archival Backup, the transfer must be fully automatic. The enduring Archival Backup itself may serve to generate clones that are exactly the same.

THE ARCHIVAL SYSTEM

One Pass Archival Backup Media:

- Direct Non-Fade Polyester Color Reversal Backup (16mm).
- Direct Polyester Panchromatic B&W Backup (16mm/35mm).
- Double B&W bi-lateral variable area optical sound Backup (35mm direct playback quality).
- Film remains un-encoded and can be reconstructed by simple optical means.
- Silver images on a polyester-based black and white film are proven technology that will last hundreds of years if stored as recommended.

  These materials have been used for:
  (a) black and white motion picture images
  (b) YCM separations of color motion picture images
  (c) analog optical sound-tracks of a number of channels
  (d) digital optical sound tracks of many channel numbers
  (e) for extended-term storage of documents on microfilm.
- Three non-fade B&W pan separation YCM polyester negative backups.
- One or more metadata backups in the form specified for access and consultation. As with film, YCM color separations can be made to protect the color information of content.

Convergence between various ways of capturing images and sound offers the benefits of film technology to protect them for extended-term survival. Creating Archival Backup surrogates when TV productions are new and just once is a lot less expensive, simpler and kinder to content than perpetual reformatting in order to meet a rich diversity of access applications.

To facilitate browsing, access, research and long-distance dissemination, digital data surrogates can be made simultaneously when the archival backup is first made, reducing labor costs.

One Pass Archival Backup Verification:

- Simultaneous three YCM pan separation backup playback.
- One Blu-Ray DVD verification copy for approval and/or
- FTP Server posting of a file for Internet verification and approval

Technology is in place now to produce YCM elements from film images, I propose to use the same approach for video source materials. We have learned that it is very important to verify that such records have indeed been made correctly. That is why a Blu-Ray DVD verification copy can be recommended, or for long-distance approvals, verification from a server.

JOIN THE ARCHIVAL APPLICATION PROJECT

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The Archival Backup System depends on a number of existing technologies as well as upgraded and new technologies. It generates new services for laboratories and post houses, who need efficient means to provide these services. It creates new demand for panchromatic and high resolution silver emulsion black and white film stock, recording and processing business. It is proposed to form a Consortium of Experts to define your expectations of such an enduring Archival Backup and to develop solutions that meet the requirements.

Participants will benefit from the development of new knowledge which after testing prototypes, can be licensed and used worldwide. We have access to some development funding, the rest will be raised from participation fees.

We invite interested parties to announce their interest as soon as possible.