



PREFACE

Edifis restoration products comprise a family of multi-purpose, economic and rapid return-on-investment systems that will be purchased by a wide variety of users. This white paper has been prepared as a companion to the Edifis User Manual, with those people in mind who have little or no background in film and video restoration.

The white paper shows several system designs for using Edifis restoration products, both at Standard and High Definition resolution. Terms are highlighted as they are introduced, and defined alphabetically, in a glossary at the back.

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THE EDIFIS RESTORATION FAMILY

INTRODUCTION

This is the ideal time to answer the questions "Why a family of systems?" and "How are they different?" The detailed explanations appear in each functional area of this white paper, but by way of basic definition:

Classic Scratchbox is the easiest to learn, fastest to use and cheapest to buy, dedicated de-spotting system on the market today. The Return on Investment (ROI) can be measured in weeks, not years.

Classic Scratchbox Plus integrates low-cost desktop PC paint applications, such as Adobe Photoshop, increasing the original feature set of Classic Scratchbox and removing the need to use expensive finishing and compositing suites for purposes for which they were not originally intended.

Classic Scratchbox and Lucifer enhances the manual aspects of Classic Scratchbox by adding automated processes to remove artefacts such as **scratches**, dust or **grain** that occur randomly yet persistently.

HD Scratchbox is designed for removing the visual effects of scratches and dirt at film resolution. In addition to employing the same easy-to-use interface and features as Classic Scratchbox, the system also embraces **primary colour correction** for perfect repair and colour matching.

All systems are disk-based; comprising up to 19 hours of **10 bit** standard definition video and digital audio storage.

REASONS FOR A RESTORATION SYSTEM

People working in restoration of film and video usually define noise reduction as reducing film grain and other types of general random noise, and differentiate this from specialised algorithms that target specific kinds of noise, such as scratches and dust particles, speckles and the like. In practical terms though, any **artefact**, no matter what caused it, detracts from the quality of its content and should ideally be removed.

Thus, if the preceding paragraph is true, nearly all material passing through a facility will require some form of restoration, at some time. The primary objective of Edifis restoration systems is to make that restoration process quicker, easier to perform and finally, better value for money. Secondly, Edifis restoration systems should be used in preference to expensive edit suites, all of which are perfectly capable of restoring content but are a totally inappropriate, and wasteful, use of resources, due to their slowness and high capital-cost.

The most common reasons for restoring film and video content are:

Re-purposing film originated material for TV broadcast

Dust and sparkle reduction, but not scratch removal, can either be done during telecine transfer to tape or during dedicated restoration. The latter is far better since the transfer itself is in real-time and not affected by noise reduction artefacts. Once artefacts are introduced in the transfer there is no return. You have to retransfer the film to fix the problem, or restore the tape itself.

Secondly, dedicated restoration, including scratch removal, is most cost-effective if performed in its own low-cost area rather than tying down an expensive telecine suite, which would be better employed doing the job it was originally purchased for!

DVD

Using an integrated restoration and storage system before **DVD** mastering is highly effective.

Once material has been recorded into and, restored using an Edifis system, the finished project can be played out by Edifis and accessed by the MPEG authoring system for compressing, whilst Edifis is simultaneously recording the next project for restoration. There is no other dual-channel; high capacity uncompressed video systems available today, able to improve the DVD workflow in such a positive manner.

Film to film

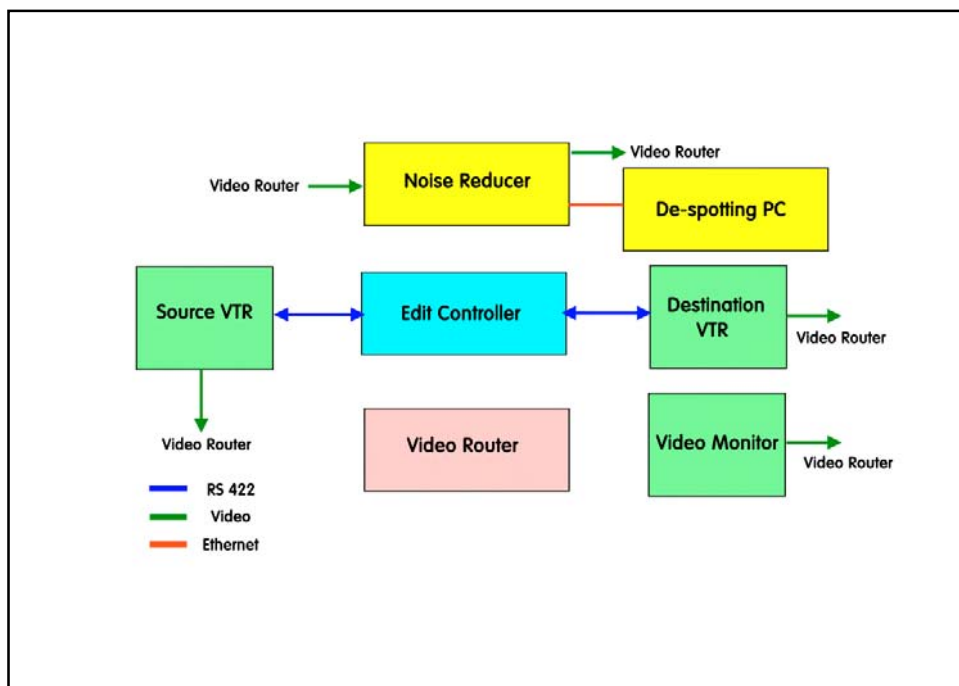
Traditional film archive restoration demands that a film be restored to a final format and image as close to the original as possible, and must be a film print capable of projection in a cinema, or similar venue.

HD Scratchbox is a higher image resolution counterpart to Classic Scratchbox. It shares the same easy to operate user interface, short training period and fast return-on-investment as its standard definition fellow but at a resolution better able to represent the qualities of film.

1080/25i represents a format containing 1920 pixels per line and 1080 active lines per picture, scanned at 25 frames per second.

Characteristics of HD Scratchbox are its large storage capacity (6 hours HD, 30 hours SD), ease of use, speed and multi-resolution capability i.e. storage and restoration of **625 PAL**, **525 NTSC** and HD material.

Traditional restoration suites are expensive to purchase, are complicated to install and commission and require lots of different manufacturer's equipment. Edifis systems, on the other hand, are simple to set up, great value for money, easy to learn and use. A typical restoration area is shown below.



Traditional Restoration Area

DESIGNING YOUR SYSTEM

All of the following Edifis restoration systems share characteristics that are not usually found in other restoration system manufacturer's offerings, such as;

Edifis Restoration Systems Family

- Full VTR control for acquisition of material to be restored and layback of finished material, either:
 - to a "destination" VTR or
 - to act as a source, or "virtual VTR" for the MPEG encoding process
- Up to 19 hours storage of standard definition video resolution content, more than enough capacity to hold multiple work-in-progress
- PAL or NTSC projects can be stored in the same system, as can HD material
- Dual Input and Output allowing content to be recorded whilst, simultaneously playing out other material

CLASSIC SCRATCHBOX

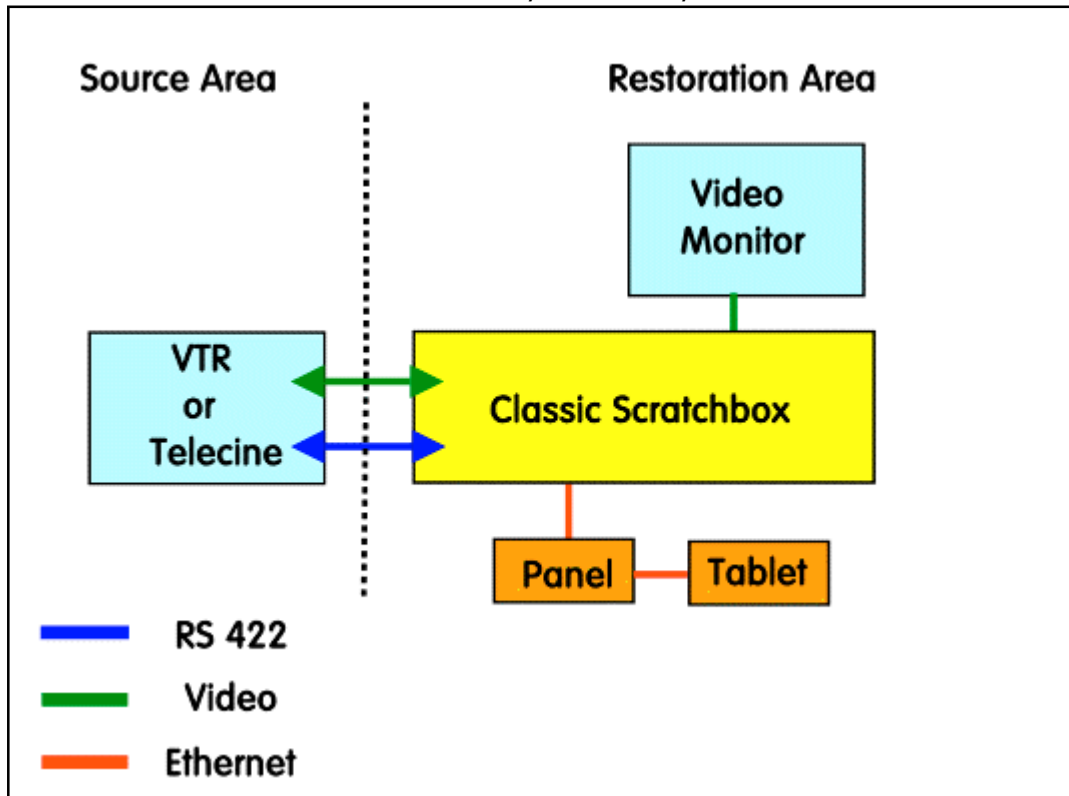
Classic Scratchbox is the easiest to learn, fastest to use and cheapest to buy, dedicated video restoration system available today.

The Return On Investment (ROI) can be measured in weeks, not years like many other systems and its real success can be judged in that archives, previously considered too expensive to be accessible are now being actively restored by Scratchbox users world wide.

Much of the market for video restoration is to produce blemish free masters for subsequent DVD Encoding or for transmission as videotape by broadcasters or cable companies.

The material may have originated from film and been subsequently transferred to tape, or have been shot as video in the first place. In either case, due to its probable age and repeated usage the material will require repair or the removal of visual artefacts before it can be used again. A limiting factor is the high cost of restoration, when material such as this is processed through high-end edit or noise reduction systems, which have to recover their capital cost through high charge rates.

Classic Scratchbox was designed from the very beginning to be a dedicated video restoration system. It is not a tool, incorporated as part of a larger system such as non-linear editor or noise reducer, but a complete application, dedicated to the single purpose of removing the visual effects of dust, scratches, punch holes and splices.



Classic Scratchbox Block Diagram

Very little extra equipment is required to start work with Classic Scratchbox. Material to be repaired can be loaded into the de-spotting area, from a source VTR or telecine in another part of the building. Machine control of the source is from the Edifis panel. No **edit controller** is required. The only additional requirements are a SDI or RGB monitor, to view the repairs in real time, and a desk and chair.

Implementing an internal keyer and mixer, a soft edged matte or **key** is painted over a damaged frame using a tablet and pen interface. The operator composites, or mixes, between the damaged foreground and undamaged background layers using this key. In effect, the scratches, blemishes and sparkle are painted away and replaced at a stroke by good material. The resulting repaired frame is re-recorded at the press of a single button.

Unlike a VTR, there are no **pre-rolls** and no degradation of image quality through generation loss, which combined mean speed and quality are always of the highest order. The storage capacity, expandable to 19 hours means that many jobs can be held at one time, again improving productivity.

Once video has been restored by Classic Scratchbox, the system can act as a source VTR to an **MPEG-2** Encoder for DVD Authoring. As implemented for DVD, MPEG-2 encoding is a two-pass process that guarantees the best possible picture quality. Using Classic Scratchbox as the video source eliminates costly VTR use and high maintenance costs, giving substantial savings to the small and large facilities. It might even prompt the smaller DVD facility to keep the image restoration work in-house.

No other video restoration system today:

Is as low-cost, fast and easy to use

Is dedicated to restoration alone

Complements more expensive noise reduction systems like DVNR & Archangel

Has 19 hour uncompressed video and audio capacity, if required

The major features of Classic Scratchbox are:

Cue Dot Removal

Cue dots are large circular marks that appear in the upper-right corner of a movie screen and are there to let the film projectionist know that it's time to change reels. Film reels generally range in length from 20 to 22 minutes, so there are several reel changeovers in a feature-length film.

Classic Scratchbox simply paints away these annoying artefacts, regardless of any underlying motion in successive frames.

Film Splice Repair

Splices are any types of cement or mechanical fastening by which two separate lengths of film are joined together so that they function as a single piece of film when passing through a telecine. Many archives have films that have been manually spliced which cause problems, such as going out of rack, during telecine transfer to tape or in which the splice itself becomes a visible artefact.

Classic Scratchbox uses a rectangular mask to paint over the effects of horizontal and vertical film splice repairs on single and sequences of frames.

Integrated acquisition tools

Classic Scratchbox can load material from tape to disk by specifying In and Out time codes, automatically locating, locking, recording, stopping and saving content as clips.

Once the required time codes have been entered into Classic Scratchbox, and the **GET** key pressed by the operator, the system automatically checks for sufficient free recording space and valid in and out times. The recording is created as a new clip with a title.

By pressing the GET key, the system takes control of a source VTR, through Sony **9-pin protocol**, locates to the required start timecode and sets up the recording process. After normal completion of the record process, the system pauses on the out point.

Dual Input and Output

Underneath the Scratchbox application are two DDRs sharing common storage. Each **DDR** is capable of recording or playing video, independently from the other, and in this sense acts like a "shared server". Thus, a finished project can be passed onto the next process whilst, simultaneously, recording in new work which should present a huge improvement in efficiency over VTR-based workflow models.

Fix, Paint and Grab

The Classic Scratchbox user interface is simplicity itself as all restoration functionality can be controlled from one menu on the system control panel, and a tablet and pen. This menu also allows use of the transport controls and jog wheel.

Classic Scratchbox operates on four layers of image data:

1. Foreground Video
2. Background Video
3. Mask layer
4. Matte

The mask layer is used to cut a hole in the foreground, which is then eventually filled with picture data from the background layer. The matte layer is sometimes used to see the hole by compositing, or mixing, between the foreground and matte using the mask.

To begin, select the damaged frame to be repaired and press the FIX button. This macro mask clears the matte layer of previous work and sets the background layer to the frame just before the damaged frame. The pen is set to paint the mask, but for speed of use, the mask is not visible when painting.

Then simply begin painting over the problem area or blemish. When a suitable result has been accomplished, pressing the GRAB button records the result

Pan and Jog Background

Most of the time, the Fix, Paint & Grab Model will suffice for repairing blemishes. However, sometimes there is motion within the damaged frames that cannot be simply solved using Fix, Paint & Grab.

Classic Scratchbox has simple to use tools that **pan** and **jog** the "good" background frames from which the repair is to be lifted so that a precise match can be composited, or mixed, into the damaged foreground.

Logging the session

All repairs in Classic Scratchbox are recorded and can be retained in the form of a paper log or saved to floppy disk, which may be offered to the client as proof of work completed and avoiding later disputes.

A log of work-to-be-completed is also possible when recording the original, damaged project. This takes the form of electronic marks, or cue-points, on the project timeline in Classic Scratchbox. Unlike tape and VTRs which require jogging and shuttling between cue-points, the Classic Scratchbox operator can instantly "jump" or locate to these cue-points, making the whole repair process quicker and less mechanically intense.

Frame Accurate Layback to VTR

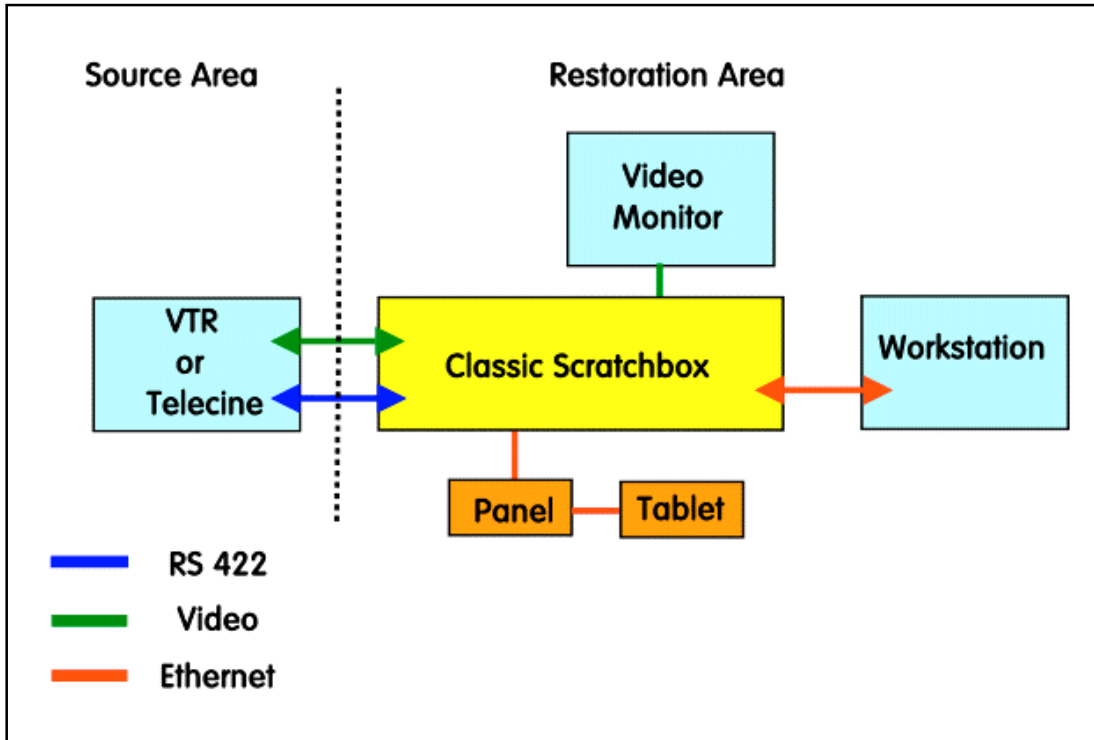
The LAY procedure allows the operator to frame accurately, transfer restored material from Classic Scratchbox to tape.

The entire clip loaded on Classic Scratchbox can be written back to tape using the **LAY** function. The in point on tape is defined by the value of the in point of the clip. No out point is required because the whole clip will be laid back to tape.

Setting the in time code of the tape to be the same as the in time code of the clip on disk, and assuming that the clip was created from a GET off the same tape, allows a perfect frame accurate **insert edit**.

CLASSIC SCRATCHBOX PLUS

In standard definition working, there are some pixel manipulation effects that are beyond the scope of the Classic Scratchbox and it is for this reason that Classic Scratchbox Plus was designed. Such effects are typically inserting text and painting on pictures, or repairing the visual effects of spliced frames "bouncing" out of rack, when passing through the telecine gate. There are many computer-based applications on the market for such work and, amongst the most popular is Adobe PhotoShop™.



Classic Scratchbox Plus Block Diagram

Upgrading to Classic Scratchbox Plus is as simple as purchasing, from Edifis, PhotoShop™ Plug-ins and a Gigabit Ethernet capability for the existing Classic Scratchbox. The PC to run PhotoShop™ and the image manipulation application itself can be purchased by the end-user.

Classic Scratchbox Plus integrates the world of standard definition **YUV** video, with that of computer-based **RGB** paint packages. The physical connection is through a **Gigabit Ethernet** switch and file conversion from one format to the other is performed within Classic Scratchbox Plus.

CLASSIC SCRATCHBOX AND LUCIFER

Classic Scratchbox was designed specifically, as the cheapest way to repair damaged film and video material. The mechanism employed is inherently manual. The defect must first be located – then repaired. Scratchbox's simple but easy to use interface has allowed the operator's skill to be applied to jobs previously considered uneconomic. Now, with the addition of Lucifer, Edifis are applying the same economic, technical and operational drivers that have made Classic Scratchbox the premier de-spotting system.

The Lucifer option complements Scratchbox. It enhances the manual tools of Scratchbox by adding automated processes. These may be applied to scenes, before, after or during the normal Scratchbox operation. The fine balance of man and machine based restoration offers advantages of both subjectivity and objectivity, but at a price previously unheard of in the restoration arena.

The lower cost of Scratchbox and Lucifer, compared to competitors plus the fact that it is not dependent upon, or tied to, particular types of telecine, colour correctors or VTRs, makes possible a faster Return On Investment, with lower capital and running costs and improved margins.

Background

There are two separate but inter-linked stages in the restoration of any movie material. First the defect must be identified. Second it must be repaired. These two stages are required in any possible workflow.

To ensure that the system can be used economically, the total cost of operation must be taken into account. Both operator salary and technical infrastructure contribute to this. The Classic Scratchbox user interface is exceptionally fast to learn. Classic Scratchbox requires no external support – save a monitor to view the images on. Storage is an inherent part of the system. This leads to a completely different financial model as compared to traditional noise reducer technology which, required external VTRs to source AND record the results. The dedicated functionality of Classic Scratchbox has already, and greatly, changed this way of working.

Whatever automated repair systems may be used for grain reduction or remove sparkle they must all perform the same basic functions of detection and repair. Any automatic system will be prone to incorrect-detection and also faulty repair. The final decision as to whether a repair is good or bad is subjective and must be made by a human being. This interaction naturally requires the result to be inspected and approved – or rejected. Scenes or frames may need to be re-filtered. Often the full impact of a certain type of repair may not be seen until in the full context of the finished job. Backtracking can be extremely expensive and slow.

Lucifer filters typically have three components. The front-end detector component builds a mask that "looks" for certain defects. Detection will often be acceptable over a wide range on images, however, some "excessive" detection may occur. This is often true when the target **artefacts** (dirt, **tramlines** etc) pass over or cover good image detail. A second-stage mask filter then removes or reduces the detector around areas of excessive detail.

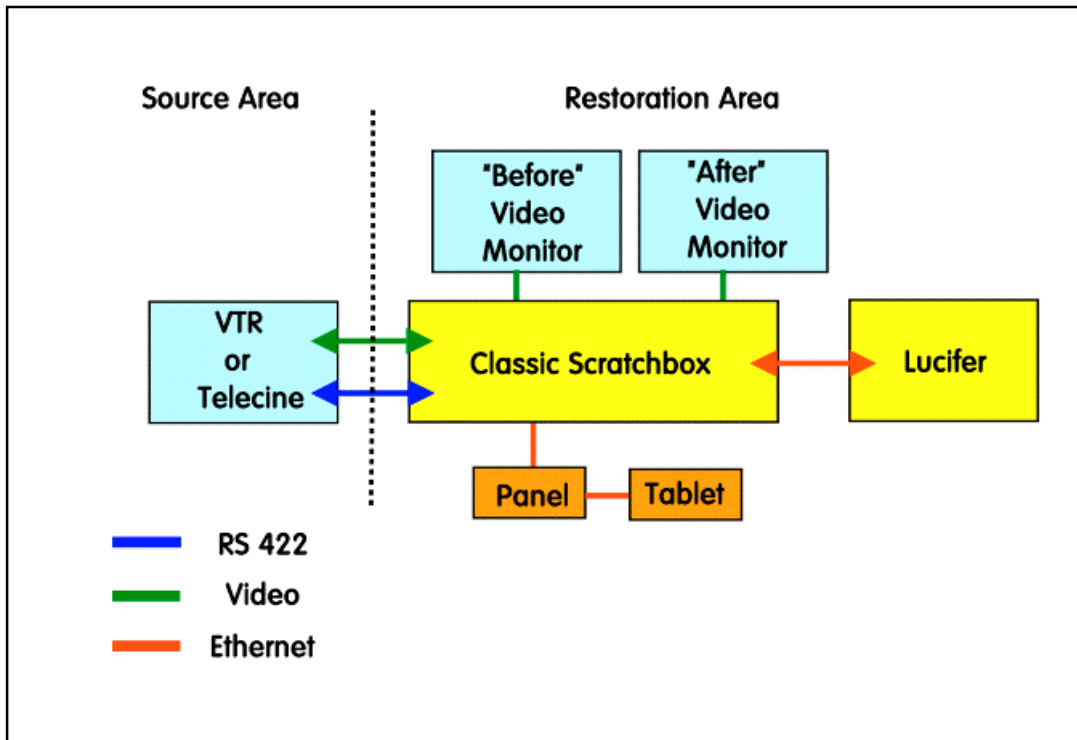
The resulting mask is then suitable for compositing the defective image with a "fill" image. There is naturally a range of possible choices of fill including filtered versions of the same or different frames.

Usually, the Lucifer filters are applied to content on a scene-by-scene basis. Very serious artefacts such as the visual effect of film tears cue dots and other problems may be repaired first. Defects that affect specific parts of the image are addressed, usually with dirt or noise filters. Less random damage such as tramlines may be addressed following the initial, "coarse" processing.

Specific filters may be applied to individual scenes and Classic Scratchbox used to manually, and quickly, remove remaining blemishes, beyond the range of individual filters.

Finally, there may be a process of **grain reduction**, although this is often done selectively, depending on the level to which it is required. Film is considered "grainy" when, under normal viewing conditions, it appears to be made up of distinguishable particles, or grains. This is due to the grouping together, or "clumping" of the individual silver grains, which are by themselves far too small to be perceived under normal viewing conditions.

Lucifer employs specific grain reduction filters, which like the dirt; noise and tramline filters are manipulated from the same panel as Classic Scratchbox.



Classic Scratchbox & Lucifer Block Diagram

Lucifer is an upgrade option to Classic Scratchbox. The source machines remain the same, as does the restoration area except for the optional addition of a second video monitor.

Workflow

Acquisition of material need not be performed manually. An **EDL** or cutting list can be imported into the system – the external tape machine is then driven automatically to batch record all of the required material. Some or all scenes are processed, De-spotted as required and then played back to tape using the in-built tape-edit-control. No third-party edit controller is required.

Automated techniques have been developed to address certain common defects. Tramline filters are designed to detect vertical scratches that run between frames. Dust filters look for single frame specks which "sparkle". Dirt and **emulsion** damage of various types can be detected and film grain can be reduced. Repair can be configured in several ways using statistically matched fills or adjacent frame fragments.

Most fundamental to the economic arguments of employing such a system is the ability to view and compare restored image sequences, on two video monitors i.e. 'Before and After'. The original material remains untouched and processed scenes are automatically spliced into the output channel. A simple wipe can be performed between input and output channels. All without the use of VTRs save for the initial loading operation.

The mechanism of detection and correction is also applied to grain reduction by applying filters to certain areas of the image that contains low detail only. High detail (titles, faces etc) are left intact.

The automated processing is performed on a scene-by-scene basis. The processed results are kept separately from the original. Both can be viewed in real-time. The system automatically manages the new and old material. The familiar Classic Scratchbox interface is then available to remove damage that is more economic to treat manually.

A record of all changes is kept in the form of an Edit List. This can be used as the basis of generating multiple versions for different output mediums such as World Wide Web, DVD and TV Broadcast.

A paper log of the work done can be generated. Classic Scratchbox with Lucifer offers a complete restoration solution for both financial and technical reasons.

System Description

Classic Scratchbox and Lucifer system comprises a **6RU** rack-mountable system with 8 hours of built-in disk storage as standard. Storage upgrades to 19 hours are available. The user interface is a dedicated panel with transport and jog controls, coupled to a familiar pen and tablet.

The Lucifer processor is operated from the Classic Scratchbox panel.

EDL/Cut List entry and Work Log extraction occurs via an external PC which can be supplied either by Edifis or the client.

In addition to all of the functionality of Classic Scratchbox, Lucifer also features:

Integrated filtering and storage

Many restoration systems are tape-to-tape in operation i.e. they rely on additional VTRs to provide play in of source material and destination VTRs to record the restored result. This is both wasteful of expensive VTR resources but unnecessary as well.

Having large amounts of integrated storage allows a user to acquire material only once and then free up the source device completely, not an inconsequential benefit if the source device is a telecine. Typically, a good quality telecine-to-tape/disk transfer takes 4 to 5 times longer than the length of the film, especially if the film is of poor quality, which makes it vital to use resources wisely and cost-effectively.

In addition, the destination device required to record the restored material would not be needed until the last possible moment.

Non-destructive repair

The greatest advantage of integrated storage can be optimised by Lucifer functionality, which allows damaged sections of material to be copied internally, stored on disk, repaired and reconstructed together with good sections to make a final, restored version. In effect, two versions of material now exist – one original and one repaired copy of the former. The original material is never destroyed, simply put to one side.

Unlike all other systems which repair content by "over-writing" the damaged sections, Lucifer always retains the original, damaged material in its disk storage and if required, this material can be re-worked or different repairs made to it. Very useful if the first repair did not pass customer Quality Control and has to be reworked!

Batch GET or Acquisition

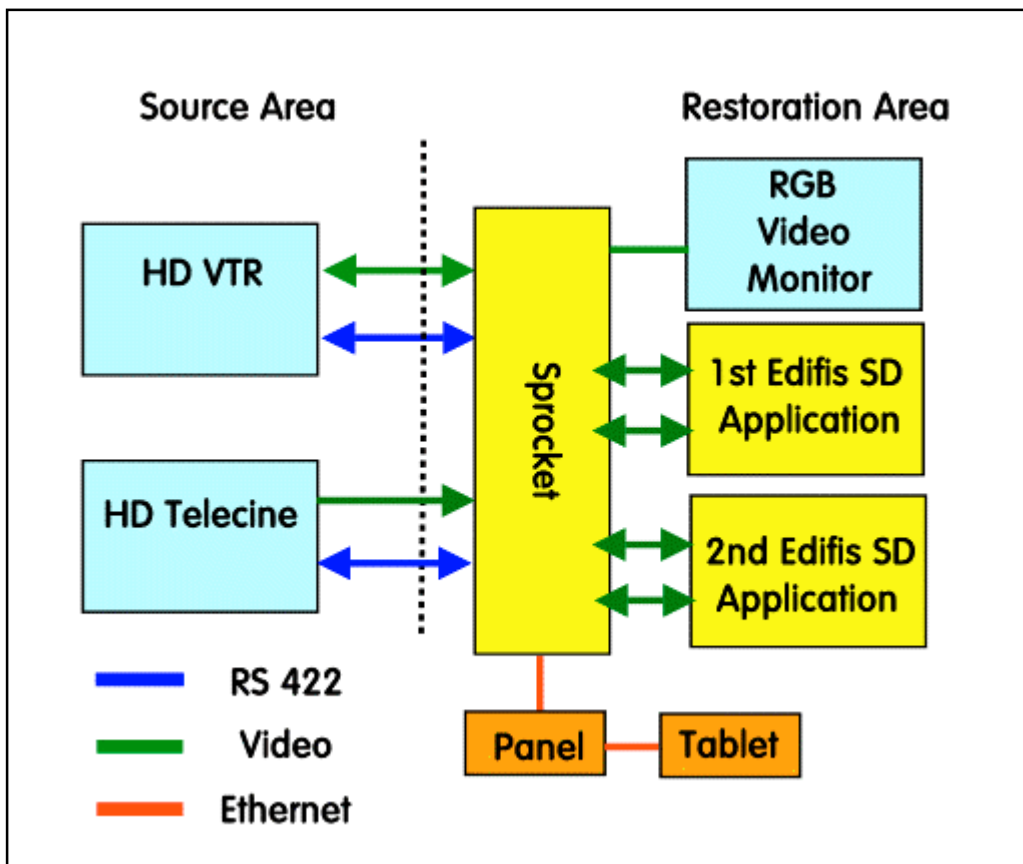
As the volume of material to be processed through Lucifer is likely to be high, the ability to record sequences of clips in as fast a manner as possible becomes ever more important. The **Batch GET** function controls a source VTR and allows multiple clips to be recorded from tape to disk.

HD SCRATCHBOX

Film is the ultimate universal storage medium. It is independent of any television system and will be playable in all current and future television standards. However, unless properly stored and handled the useful life of film reduces from several hundred years to a mere few decades, possibly only ten years in the worst case.

Many of these films contain recordings that are of great historical interest and have a value impossible to estimate, which makes their preservation and/or restoration doubly important. Unfortunately, many films are stored in less than ideal conditions where the temperature, air purity and humidity are affecting not only the image but also the physical acetate-based material on which the image is contained. Some broadcasters consider that transferring endangered film to a video recording is an economic alternative to film-to-film transfer. Unfortunately though, the future potential of film for re-use has been lost and with it comes the thorny problem of picking the right video standard and a host of other problems not encountered with film.

There are millions of hours of film based material contained in archives, much of which could be conceivably be used again if it were of suitable quality. The fact that it is not used is largely due to its poor physical condition caused in part by poor storage and the high cost of restoring it to its original glory. In many cases, it is simply not economically viable to consider restoring film and its potential for exploitation is lost forever.



HD Scratchbox Block Diagram

Like its standard definition companion, HD Scratchbox is dedicated to image retouching and scratch removal combining high storage capacity and matte painting within one, low-cost system.

HD and multiple SD revenue earning potential

However, the benefits of HD Scratchbox are not confined to image restoration. The HD storage constituents of the system are in fact, TWO stand-alone SD applications in their own right and can be utilised for telecine, **MCR**, VTR replacement, image restoration, **time-delay** and many other uses. Thus, having two SD revenue-earning opportunities as well can enhance the financial benefits of using HD Scratchbox even more.

In addition to the compositing tools available on the SD Classic system, HD Scratchbox has a number of additional features dedicated to film specific (rather than tape to tape) issues.

Primary Colour Correction

The more serious defects such as tears or actual missing pieces of film **emulsion** can invariably be repaired using parts of the same frame or nearby frames. In the case of the same frame, a piece is taken from one part of the image and used to replace another - despite possible light and tone changes. If a nearby frame can be used, then there may still be variations on overall colour balance. In the SD environment this effect is easier to ignore.

In HD resolutions the effects are more pronounced. The addition of an Edifis designed **primary colour corrector** in the source image data path, allows very fast correction of these effects. This greatly increases the available repertoire for damage concealment and repair.

HD Scratchbox is designed to quickly and easily remove the many forms of scratches which are caused by external objects coming into contact with the film, such as equipment components, or dirty or worn rollers in the film path. It is also ideal for removing other blemishes caused by **ferrotyping** or **cinching** and even cue dots can be removed with ease. The system is modular, comprising as it does of 2 Edifis Standard Definition Sting Servers and one Sprocket multiplexer containing an internal compositor, mask layer and painting tools.

Modular architecture

This modular approach permits the individual units to be utilised for standard definition working whenever required and combined to work together whenever a HD project is to be completed. The economies of scale made possible by multi-resolution equipment are a necessity but is rarely seen in much equipment available today.

The major features of Classic Scratchbox have been carried forward into HD Scratchbox such as ease of use, speed of operation and low cost.

GLOSSARY OF TERMS

6RU: One-rack unit equals 1.75 inches in height. Therefore, a 6RU system occupies 10.5 inches in height, when installed within a standard 19-inch wide rack.

525 NTSC: The colour television standard in USA, Canada, Japan and elsewhere where 525/60 defines the line and field format

625 PAL: The colour television standard in most of Europe where 625/50 defines the line and field format

9 PIN: Normally the Sony RS 422 protocol. A 9-pin port on a VTR enables the transport and arming to be controlled by another machine, such as Classic Scratchbox. A serial cable between their respective 9 pin ports connects the VTR and Classic Scratchbox

10-BIT: Signifies the amount of levels in the digital signal. There are 1023 levels in a 10-bit signal

ARTEFACT: An undesirable element in the film or video picture that was not present in the original when it was created

CINCHING: Caused by dirt becoming embedded in the film surface and marking the film, when it lies in loosely wound rolls

CUE DOTS: Cue dots are large circular marks that appear in the upper-right corner of a movie screen and are there to let the film projectionist know that it's time to change reels. Film reels generally range in length from 20 to 22 minutes, so there are several reel changeovers in a feature-length film.

DDR: DIGITAL DISK RECORDER, a device that records video and audio information on internal magnetic disks rather than magnetic tape. Edifis DDRs have high recording capacity, uncompressed video quality (8-bit, 10-bit, PAL, NTSC, HD) and the ability to perform special functions such as speed changes, loops, time-delay, split audio and much more.

DVD: DIGITAL VIDEO DISK, a format on which MPEG-2 compressed video is stored on a CD or compact disk

EDIT CONTROLLER: Computer based device used in editing that manipulates and synchronises a wide variety of video and audio equipment such as VTRs and DDRs, to make frame-accurate edits

EDL (Edit Decision List): A list of the decisions that describe a series of edits that are produced by an electronic editing system. The EDL contains information that identifies the location of source material and builds the edited master

FERROTYPING: A smooth or shiny blotch or series of blotches on the film emulsion surface, which is caused by the action of heat and/or moisture with pressure

FILL: The video information that fills the "hole" cut in the video signal by the key signal

FILM SPLICE: Film splices are any type of cement or mechanical fastening by which two separate lengths of film are joined to together so that they function as a single piece of film when passing through a telecine, projector or camera

GET: Automatic function where any Edifis system can take control of a source VTR, through Sony 9 pin protocol, locating to a required start time code and setting up a process where desired material can be recorded directly into the Edifis.

GIGABIT ETHERNET: A development of existing Ethernet technology to support higher data transfer rates e.g. 1000 Mb/s. Data may be transferred over either copper or fibre optic cable

GRAININESS: The character of a photographic image when, under normal viewing conditions, it appears to be made up of distinguishable particles, or grains. This is due to the grouping together, or "clumping" of the individual silver grains, which are by themselves far too small to be perceived under normal viewing conditions

INSERT EDIT: A "cut" which is inserted into an existing video sequence

JOG: A transport control mode in which picture content stored on Edifis systems is moved forward or backward a small amount at a time

KEY: A signal that can electronically "cut a hole" in the video picture to allow for insertion of other elements such as text or a smaller video picture

LAY: Automatic function where any Edifis system can take control of a destination VTR, through Sony 9 pin protocol, locating to a required start time code and setting up a process where desired material can be recorded directly onto the VTR from the Edifis.

MCR: Main Control Room where feeds are recorded and re-routed to destinations such as edit suites and the transmission area. MCR functions typically include duplication of material, dubbing audio onto tape, preparing for playout and Quality Control processes

MPEG: Moving Pictures Expert Group. A form of hardware-assisted compression. Whilst JPEG is based on still images, MPEG is based on motion. It is a lossy compression method i.e. content is removed from individual frames, permanently during the compression process

PAN: A technique used in all Scratchbox applications, using the full height and width of a picture to select that piece of a video frame judged to be the most useful to use for repairing an artefact elsewhere on the frame

PRE-ROLL: The period required by a VTR for the run-up from the pause function and switching into the play or recording mode. Typically five seconds

PRIMARY COLOUR CORRECTOR: A device that stores colour-corrected parameters, on a frame-by-frame basis and is able to reproduce these settings in real-time. Primary colours in the video world are red, blue and green and, when combined in various proportions can produce any colour in the visible spectrum

RGB: An abbreviation for the primary colours; red, green and blue. Cameras, video and computer monitors work internally with RGB signals. Video systems such as Classic Scratchbox do not store RGB signals, using instead, signals derived from RGB i.e. luminance and colour difference signals

SCRATCH: Caused by external objects coming into contact with film, such as equipment components or dirty or worn rollers in the film path. The unevenness that a scratch creates on the film causes refraction of the light projected through the film

TIME DELAY: A process of recording material, storing it for a specified time ("the delay") and then replaying the same content. All Edifis two-channel systems are capable of time-delaying a video signal

TRAMLINES: A continuous, often vertical, scratch across one or many frames. External objects, such as bits of equipment, or dirty or worn rollers coming into contact with the film cause tramlines

WIPE: A transition between two video signals that occurs in the shape of a selected pattern