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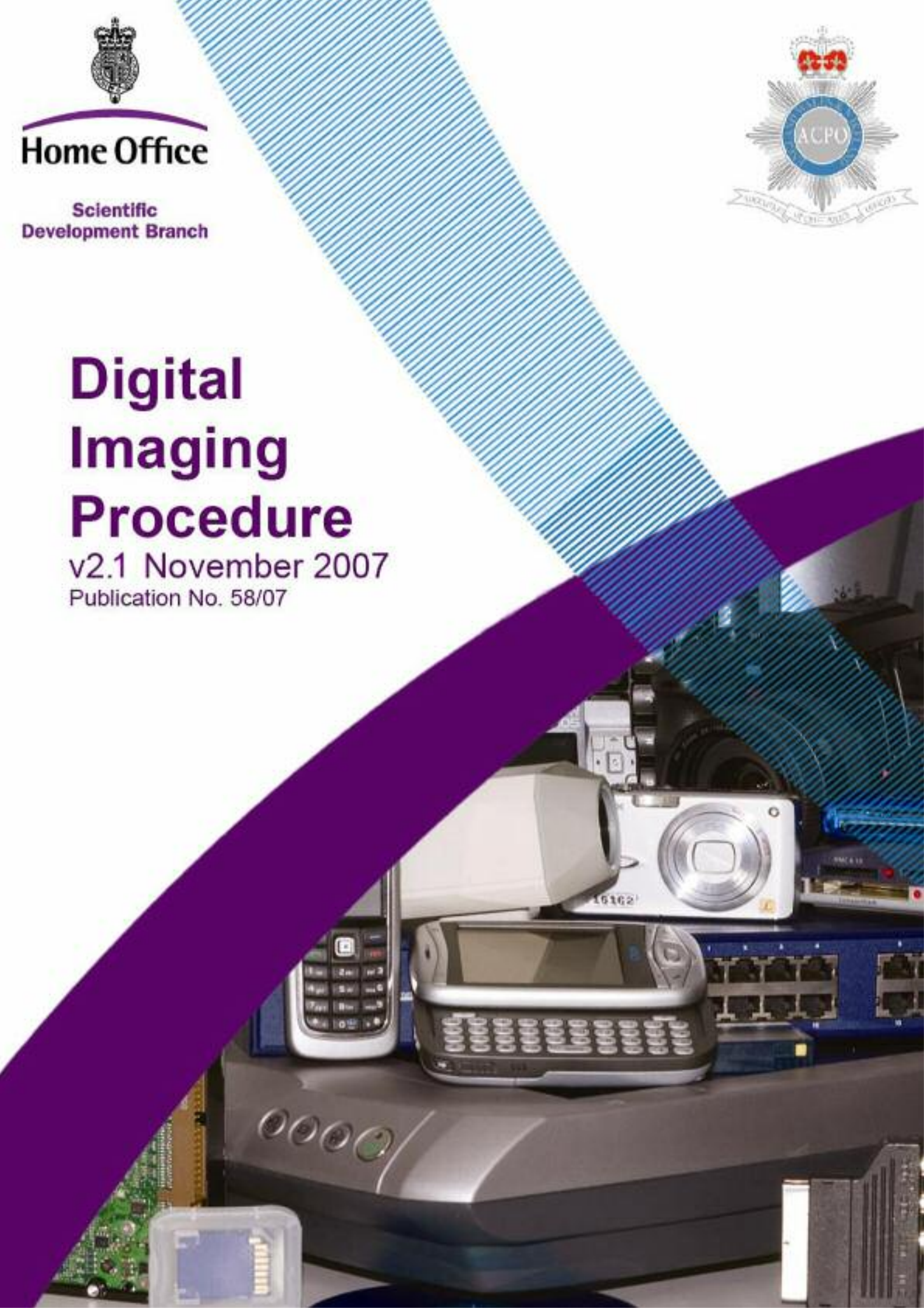
**Scientific
Development Branch**



Digital Imaging Procedure

v2.1 November 2007

Publication No. 58/07



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Neil Cohen
Ken MacLennan-Brown

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With acknowledgement to Jim Aldridge and the project team who developed the original Digital Imaging Procedure on which this publication is based.

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Foreword

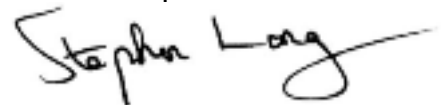
Digital imaging has become firmly established in the mainstream of public life and as a key enabling technology for the Police Service. With this in mind it was time to revise the *Digital Imaging Procedure*, first published in 2002. The aim of this new version is to build on the success of the original document and not only reflect current advances in technology, but also look to the future. The principal purpose of the procedure remains the same, i.e. to detail the processes involved in the proper capture and handling of digital images for police applications and to define best working practice. The target audience also remains broad, encompassing operational, administrative and judicial staff involved throughout all stages of the Criminal Justice System (CJS).

The key to the process is the creation of an identifiable and isolated Master reference copy at the earliest opportunity, whether on WORM media or within a secure network environment. This procedure enhances the integrity of proper evidential gathering processes whilst reducing the risk of malicious manipulation. Every effort has been made to keep the document as generic and technology-neutral as possible, however specific technologies and processes are addressed as necessary and references given for sources of more in-depth advice.

Digital imaging has enormous benefit for the swift and accurate outcome of investigations, particularly given the fuller use of network technologies. Whilst such technology has a price tag in terms of infrastructure and skilled technical support this is an enabling document that allows for the adoption of suitable technologies as the opportunities present themselves.

This document is not intended as a final or definitive report, as digital imaging and associated computer technology is a rapidly developing environment. We expect that operational implementation and court proceedings will refine some of the procedures set out in this document, although the framework itself is considered robust and defensible, and has been widely adopted since its original publication in 2002.

The information contained in this procedure has been derived, developed and reviewed through wide-ranging consultation with practitioners from the Police Service and related CJS organisations. This document also supports the *ACPO (2007) Practice Advice on Police Use of Digital Images v1.0*. I commend it to forces and other organisations for adoption as current 'best practice'.



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Introduction

The Digital Imaging Procedure is a guide for those practitioners within the Police and CJS who are involved with the capture, retrieval, storage or use of evidential digital images. It is focused around a flowchart that guides the reader through the process from the initial preparation and capture of images, through the transfer and designation of Master and Working Copies, to the presentation in court and finally the retention and disposal of exhibits. Supporting notes are provided for each step in the flowchart.

This version (v2.0) of the Procedure maintains the overall structure of the original document (v1.0), first published in 2002, but has been updated in two key respects. Firstly, it is recognised that there is now a broader range of technologies available for the capture and storage of digital imagery. Secondly, an allowance has been made for the possibility that the Police may wish to store Master and Working Copy data on a secure server instead of physical WORM (write once, read many times) media such as CDs and DVDs.

The bulk of this document comprises notes that should be read in conjunction with the flowchart. However, there are several issues that are not covered within the Procedure itself. These are introduced and discussed briefly in this section to answer some frequently asked questions about digital imaging.

What is the evidence?

Evidence, in terms of a still image or video footage, is the presentation of visual facts about the crime or an individual that the prosecution presents to the court in support of their case. The image will be presented either as hard copy or on a screen. This document is only concerned with the handling of evidential images, not those deemed to be 'Intelligence'.

With conventional photography, the negatives are often referred to as the 'primary' or 'original' images and the prints are all made from them. Similarly, with video and analogue recording the first tape is sealed as a Master once the first copy has been made from it. A copy of an analogue tape is always a degraded version because noise is added at each copying. This is compounded by the physical wear and tear of the tape.

However, it is possible to make a bit-for-bit identical copy of a digital image file. In evidential terms there is no distinction between the copy and the primary or original file because the files are the same and have the same evidential weight. It is not important whether the file is on a stand-alone or networked computer, a server, or on any type of storage medium. This assumes the operation of adequate security against unauthorised and unrecorded access.

If no discipline is applied there can be any number of identical files. For evidential purposes it is essential to be able to demonstrate that the images are authentic and have originated from the files captured in the camera and recorded to the first medium.

Digital image files can be used in exactly the same way as conventional photography and video with written audit trails. Electronic audit trails, if available, can augment or replace the written audit trails.

Digital images should not be thought of as replacements for conventional photographs and videos but as alternative technologies. It has to be recognised that digital images are not necessarily better than conventional ones. Some lower resolution digital images displayed on a computer screen or as hard copy might not appear very lifelike – but then neither do many simulations. The important and overriding factor is that the content of the image should be fit for purpose and that the quality is adequate. To this end the use of desktop printers for hard copies of stills and low resolution video footage must not be ruled out. It is not always necessary or feasible to produce the highest quality images to demonstrate the facts required for evidence.

Digital cameras use a multitude of complex image processing techniques to combine the signals from the charge coupled device's (CCD's) pixels into an image of the subject. However, the image is a representation of the subject in the same way as conventional photographs are. No one questions the chemistry involved in the development of the tiny grains in an emulsion and how the resolution and colour are chemically produced. In video, the images are

accepted as being fully electronically processed. Video recordings are admissible as evidence and the digital storage of the images does not alter that.

Compression

There are various compression algorithms used to reduce the amount of data in an image file to reduce both storage capacity and transmission bandwidth requirements. All compression algorithms remove data from the file and some are more effective than others at reconstruction of the data for replay. Generally, the greater the compression ratio, the more seriously affected is the replay.

If an image or video sequence is being presented as evidence and illustrates the facts of the offence then it is evidentially irrelevant whether the data has been compressed or not. What is important is the compression algorithm and ratio selected for particular applications.

Some compression algorithms are more suitable for fast movement, some for 'talking heads' scenarios. The compression can produce some artefacts which may mask the information or contaminate it with movement, patterns, outlining, etc. The algorithm must be tested on typical scenes. The image quality must be agreed and performance tests carried out to ensure suitability. Image processing cannot make up for inadequate data. Images should not be excluded because they are compressed and whilst there may be reasons to prefer some algorithms for reasons of quality, there is no reason to exclude any from evidential material.

File format

Digital data files can have a variety of formats.

The still camera industry is mostly using widely supported (or open) formats (TIFF, JPEG) although their highest resolution images are sometimes in their own proprietary format. This means these latter images have to be downloaded in a proprietary software package. An open format allows for ease of incorporating images into publications, printing and transmitting to others.

The manufacturers of closed circuit television (CCTV) video recorders are using a multitude of open, proprietary and mixed compression formats to meet the needs of massive amounts of information versus the cost of storage. Again, the format is not relevant to the admission of the evidence, only that the quality is fit for purpose.

Currently digital handheld video cameras mainly record to Hard Disk Drive (HDD) Mini-DV or flash memory (CompactFlash, SecureDigital, etc). As the market grows it is likely that more recording media will be introduced.

Secure server

Server storage has many advantages, particularly with regard to long term storage. The data can be migrated automatically and with no loss within a RAID array, ensuring that the data is accessible, as compared with a CD or DVD where once it has been noticed that the media has failed it is often too late. However, careful thought should be given to the administration and maintenance issues surrounding the server-based storage of images. If it is decided that server-based storage is the desired method then the following definition of a 'secure server' should be applicable to the installation.

The term 'secure server' should be taken to mean an environment, including a security management system, which is accredited to a level of at least 'RESTRICTED' under the Government Protective Marking Scheme (GPMS), in accordance with the ACPO Community Security Policy (CSP), as documented in an associated Accreditation Documentation Set (ADS) and as approved by either the local Force Information Security Officer and/or the National Accreditor for Police Information Systems.

Integrity Verification vs. Authentication

These two terms are frequently confused and often misused*.

- **Integrity verification** is the process of confirming that the data (image, CCTV clip, etc) presented is complete and unaltered since time of acquisition. Relevant questions concerning integrity might include: "Has data been added to, or removed from the file?"; "Has the data within the file been changed?"
- **Authentication** however, is the process of substantiating that the data is an accurate representation of what it purports to be. Relevant questions concerning authentication would deal with issues such as: "Was the image taken at the time stated?"; "Was the image taken at the place stated?"

It should be noted that standard image processing techniques such as lightness or contrast changes would affect the image integrity but not the image authenticity; however, a change to the clock on a CCTV system could affect the image authenticity but not affect the image integrity. Robust audit trails are required in order to maintain image authenticity.

* Definitions taken from SWGDE / SWGIT Digital and Multimedia Evidence Glossary Version 2.2 November 2007
http://www.theiai.org/guidelines/swgit/swgde/glossary_v2-2.pdf

Preparation

These elements of the procedure include the preparatory steps before images are captured. This may be directly before the images are taken, or at an earlier stage or date where work can be anticipated. The steps identify the importance of:

- obtaining relevant authorisations;
- starting an audit trail at the earliest opportunity when it is known that the images are to be captured;
- checking equipment, either routinely or at the start of the image capture activity.

Such checks will avoid the embarrassment of failure and/or challenges about conformance with an accepted procedure. Digital image capture systems may increasingly be used by non-specialists in operational situations and locations so adherence to an established procedure will assist in safeguarding those captured images.

Obtain authority [1]

This instruction applies to all image captureurs by virtue of their role or position within the Police Service. They are empowered to capture images for the purposes of their particular work. Specific roles and responsibilities, for example for a Scenes of Crime Officer or a Collision Investigator, will be written into their job descriptions, training and instructions, together with any verbal instructions. Obtaining authority is not necessarily required for each separate operational task.

However, police forces need to be aware that authorisations do need to be obtained before some images are taken, for example authorisation to permit images to be taken where 'Directed Surveillance' is requested under the Regulation of Investigatory Powers Act 2000. That authority must be obtained and recorded within the audit trail of the operation.

Start audit trail [2]

One of the fundamental requirements of digital imaging is the need to safeguard the integrity of images; part of this process involves an audit trail being started at the earliest stage. This may be a written audit trail, and/or incorporate an auto-generated electronic audit trail mapping the movement and changes of files on computers.

This Procedure relies on the written audit of activities. Where good practice is in place for the collection of evidence, including video and still images, there will be no change in principle. In practice, there probably will be little change in existing procedures with conventional photography except that the operator may receive reusable media to reformat and use; a process familiar to video operators.

The audit trail should include the following information (with date and time of action) when available and if appropriate:

- Details of the case.
- GPMS classification of the image (and any special handling instructions, if relevant) and the name of the person who classified the image.
- If the image is third-party generated, information about point of transfer including whether the image is the Master copy, a Working Copy or an exhibit derived from a Working Copy.
- Information about capture equipment and/or hardware and software used, including details of the maintenance log relating to capture equipment and calibration of hardware and software.
- Identity of the capture operative including third parties and image retrieval officers, where applicable.
- Details of exhibits and disclosure officer(s).
- Description of the images captured, including sequencing.
- Details of retrieval or seizure process and point of transfer, if applicable.
- Creation and definition of the Master copy and associated metadata.
- Storage of the Master copy.
- Any access to the Master copy.
- Viewing of the Master and Working Copies, including a record of any associated viewing logs.
- Details and reasons for any selective capture.
- Any editing applications which may alter the image.
- Any details of processing applications allowing replication by a comparatively trained individual.
- Electronic history log of processing applications.
- Any copying required to ensure longevity of the data.
- Revelation to the CPS of the Master and Working Copies;
- Any copying carried out as part of a migration strategy to ensure the replay longevity of the image;
- Disposal details and retention time periods.

The practices may not be familiar where imaging is a new feature of the work and it may be worthwhile to consult the Scientific Support Managers or equivalent adviser.

Where detailed information is required reference should be made to *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 2.5 Starting an Audit Trail and Section 4.1.1 Completing the Audit Trail and/or individual Force procedures.

Check operation of equipment [3]

The correct operation of any equipment is essential to gathering evidence.

In particular it is suggested that checks are made to ensure that:

- operator adjustable settings are made appropriately;
- the time and date settings are correct;
- there are adequate supplies of recording media, including spares in case of media failure;
- the media should either be new, reformatted or erased in an approved manner;
- any media protection settings will not prevent recordings being made;
- if the equipment is battery operated, there are sufficient fully charged batteries available;
- a scheme of checks is carried out before deployment particularly for equipment that is used less frequently.

It is essential that time and date settings are correct, any inconsistencies should be documented and the equipment monitored to ensure that further drift of these settings does not occur.

This list is not definitive and detailed information should be obtained from the equipment manuals.

Where detailed information is required reference should be made to *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 2.1 Considerations at Capture Stage, and/or individual Force procedures.

Capture, Protection and Storage

Police-originated images

These steps cover the capture of still or video images onto the chosen medium with due regard for the image quality and integrity of the images.

Third party origination

The Procedure diagram should be used to establish the 'point of transfer' at which the responsibility for the handling of third party images transfers to the police. That 'point of transfer' will depend on the nature of images being transferred, the recording format and equipment used by the third party. At whatever stage this 'point of transfer' occurs the police audit trail must start from that point. Continuity of image handling should be demonstrated throughout by ensuring that the police audit trail links directly to any audit trail that is available from the third party.

Third party image systems

Town centre CCTV cameras, for example, should follow established and standardised procedures. These systems should allow the police to;

- take evidential recordings away in order to safeguard them;
- replay the recordings in order to view, copy and process them;
- make authentic (not materially different) copies in formats suitable for use by investigators, Crown Prosecution Service (CPS) and the courts;
- access viewing facilities if the original format recording has to be viewed.

Whichever still or video camera or format of medium is chosen for the capture and initial storage of images, effective means must be available for transferring the images to the computer system where they are to be used and possibly archived.

Take images. Do NOT delete images [4]

Generally digital still or video equipment is used in the same way as analogue cameras. Two main differences:

- a choice of recorded image quality;
- the option to delete recorded images.

Capture

The image quality setting should be selected appropriate to the operational requirements rather than to minimise the storage capacity. Operators should anticipate their requirements and have sufficient empty storage medium available.

Selective capture involves the switching on and off of recording devices and should not be confused with other editing processes. For further information on selective capture see *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 3.1.1.

Still images can be captured on many different types of camera using a multitude of memory storage devices/memory cards. The manufacturer's manual should be referred to for instructions on correct use of this equipment.

There are several technologies for capturing video images digitally. Each is illustrated in the Procedure:

- magnetic tape – includes digital recording to conventional video tape, special digital video tape and data tape;
- WORM (write once, read many times) media, for example CD-R and DVD±R;
- reusable, removable, non-tape media, for example memory cards;
- computer hard disk drive (HDD).

Because of the high data rates associated with digital video, the image data is usually compressed in order to:

- reduce the stored data volume;
- reduce the time taken to transmit and/or the transmission channel bandwidth;
- lower the cost of storage media, for example by using low read and write speeds.

Where image sequence(s) have come from a non-removable medium the Working Copy or copies could be made:

- at the same time as making the Master;
- from the non-removable media after the Master has been made;
- subsequently from copying the Master.

Deletion of images

One crucial aspect of the Procedure is that none of the images taken should be deleted without authority. Any deletion of images, intentionally or accidentally, may be the subject of a 'challenge' or legal debate during any prosecution. Where such authority is given, deletions must be recorded in the audit trail and be subject to the requirements of the *Criminal Procedure & Investigations Act 1996 and Attorney General Guidelines on Disclosure of Evidence*.

Much equipment, however, does have the facility to delete recordings. On most digital still cameras there is an option to delete image files that have already been saved to the storage medium. Video recorders are designed to allow deletion by over-recording. Images should not be deleted from the recording which will usually become the Master.

In CCTV systems, video is recorded directly to an HDD, which is often designed to over-record automatically after a set period. Before this happens some or all of the images may be protected on the HDD preventing them from being overwritten.

Transmission

Usually images will be transferred directly from one medium to another (e.g. from HDD to WORM). However, in some cases the images will be transmitted across a network. This may occur either at the point of capture (e.g. IP CCTV cameras) or during transfer from the initial storage medium to the Master.

The security characteristics of different transmission methods should be considered and where necessary documented in the audit trail. This particularly applies to wireless transmission methods that may be susceptible to interception or unauthorised access. This should also be considered when using wired network transmission, particularly if the internet forms any part of the network transmission.

Protection and Storage [5]

Images on reusable media should be copied from the original storage medium in the original file format onto a secure media. This secure media could be WORM or secure network storage. The term 'secure server' should be taken to mean an environment, including a security management system, which is accredited to a level of at least 'RESTRICTED' under the Government Protective Marking Scheme (GPMS), in accordance with the ACPO Community Security Policy (CSP), as documented in an associated Accreditation Documentation Set (ADS) and as approved by either the local Force Information Security Officer and/or the National Accreditor for Police Information Systems. Once the images and associated data have been copied onto the secure media, they cannot be overwritten or altered.

The generation of the secure copy should be carried out as soon as possible after the capture to reduce the time and opportunity for the accidental or malicious alteration to images.

All imagery Master or Working Copies should be appropriately identified in order to facilitate the storage, retrieval and eventual disposal of case material.

In terms of evidential value there is no difference between bit-for-bit copies of the data on the Master, Working Copies and the images on the storage medium. This does not remove the necessity to protect the Master as an exhibit in case of challenges to evidence handling procedures or image manipulation.

The software required for viewing proprietary formats must be available otherwise the images will be inaccessible. It is advisable to store any replay software with each recording to assist with the correct viewing of the files.

The choice of using network storage or WORM media is a matter for force policy and should be guided by factors such as volume of data, predicted storage time and longevity of WORM media. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper-proof usage logs.

Non-reusable removable medium (WORM) [5a]

Non-reusable removable medium technology includes CDs, DVDs and specially designed WORM devices. They represent the ideal in that once closed the recording on the disk cannot be altered. Other WORM media types may become available.

The WORM medium must be closed to prevent any of the image data files being subsequently changed and further data written to the disk.

Optical disks (CD-R, DVD±R) must be 'finalised' or 'closed' in the camera or CD-writer before the disk is removed otherwise the images may not be viewable on a computer.

Video images

To allow ease of current and future use of the recordings for investigations and appeals, etc, the CD/DVD should include:

- the image sequence or sequences clearly identified;
- an easily-read text file stating any requirements for special hardware or software for replay;
- all associated metadata (time and date should be bound to the relevant images);
- licence-free software enabling the sequences to be viewed correctly;

Other items that could be included:

- text data about the originating camera or system;
- audit trails;
- authentication or verification software;
- short test sequence to confirm that the recorded image sequences are being replayed correctly.

Still images

In general, still images are stored in widely supported formats and there is no need for viewing software to be stored with the images, but where proprietary formats are used then the viewing software should be included on the media in line with the information given above for sequences.

Storage

The WORM media will usually be stored as the Master. However, the creation of a network server based Master could be considered for reasons of storage efficiency or data longevity. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper-proof usage logs.

Reusable memory [5b]

These include solid state memory devices such as CompactFlash, Memory Stick or any other reusable media such as CD-RWs and DVD±RWs.

Once the image files are saved to the removable medium they may be locked via the menu functions on the camera so that accidental deletion is prevented. SmartMedia cards can also have a physical protective seal to prevent all the images being deleted accidentally but this does not prevent the card being reformatted if the seal is then removed.

Media cards may have to be formatted in the particular camera prior to use otherwise they may not accept the images to be stored. A card cannot always be formatted in one type of camera, placed in another make and be expected to work.

Reusable media are now a cheap and common form of storage used across the range of imaging devices. These media are however, only designed for short term storage and any data stored on them is vulnerable to corruption or accidental deletion and therefore should be transferred as soon as possible to secure storage.

Once images are transferred to the Master, the reusable medium must be reformatted to remove all of the previous image files in preparation for reuse. This reformatting should be carried out in preparation for the work ahead and the officer should have sufficient empty media for such purposes. Reusable media cards should be erased in accordance with force policy as soon as all data has been transferred.

Storage

Reusable memory should be treated as a transport medium and as such the imagery needs to be copied onto secure storage as soon as possible. Individual Force procedure will determine whether WORM or secure server is the most appropriate route. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper proof usage logs.

Non-removable medium [5c]

These are usually in the form of HDDs and mainly used for direct storage of video, but sometimes are also used for large file-size still images, for example fingerprints.

Because of the high cost and finite capacity of HDDs, images stored on them will usually be overwritten after a preset time or after the images have been transferred (backed-up) to some other medium for transport or archive. The back-up might be selective, by automatic or manual selection. It may be necessary to bring in specialists to ensure that the data is safeguarded.

Any difficulties with obtaining evidential material should be referred to the force TSU or video units. Reference should be made to the *ACPO Good Practice Guide for Computer Based Evidence V0.3* and *Retrieval of Video Evidence and Production of Working Copies from Digital CCTV Systems*.

The normal mechanism for erasing data recorded on hard disks is to delete the directory entry only. The computer controlling the HDD then reallocates the space ready for a fresh recording. The new recording will then erase the previous recording by writing over the top of it and a new directory entry will be made. This means the data still exists and is recoverable until it has been overwritten.

When an incident or offence has occurred and there is a requirement to take information from the HDD as evidence:

- check whether the required data has already been copied to a back-up medium;
- check that what is needed is not being over-recorded while arrangements to save the data are being made;
- stop the recording process if necessary to preserve the data – this may put the system out of action until the data transfer can be completed;
- be prepared to seize the hard disk if necessary;
- transfer the data in a file format with software for accurate replay that can be used by the police, retaining original file format if possible;
- transfer to a recording medium suitable for play by the police.

Storage

Data held on an HDD could be written to WORM, copied to a secure network, or the original HDD could be retained as the Master, though retention of the HDD is strongly discouraged due to the uncertainty of its lifespan. However, if it is necessary to seize a large amount of data from an HDD then it may be impractical to transfer it to WORM, as it may take a considerable time to copy and require many disks. It should be noted that if the HDD is retained then write-blocking measures will need to be implemented before the HDD is accessed. Furthermore, checks should be made to ensure that the data on the

HDD is in a replayable form, as an HDD from a CCTV system, for example, may not be readable on a standard computer.

It may not always be possible to make the Master directly from the HDD (e.g. a CCTV system with a network port but no CD writer). The data would first be copied to a transfer medium such as a laptop, from which the Master could then be created. Once the Master has been produced, the data would be deleted from the transfer medium. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper proof usage logs.

Removable tape medium [5d]

There are several types of tape onto which digital video can be recorded. In the case of a handheld digital camcorder the most common type at present is MiniDV.

Other formats of digital video tape recording include professional formats such as:

- DVCAM and DVCPRO;
- Digital Betacam.

Where the video footage has been recorded onto a digital tape in a handheld camcorder then this video tape will usually become the Master.

In the case of CCTV, the images may be recorded onto a data tape format. Digital Audio Tape (DAT) is one example. Whilst these tapes are removable it may not be feasible for the police to view the evidence without first transferring the data to another more convenient removable medium.

Where hard disk recording systems use tapes for back-up, the recording format may be non-standard to accommodate time lapse and multiplex recordings. These recordings will require special playback and copying facilities.

Analogue VHS copy recordings can usually be made from digital recordings though this usually entails a marked drop in quality and often causes the loss of the metadata.

As soon as an evidential tape has been removed from its recording device, the write-protect mechanism should be activated where available. This is usually in the form of a switch with two positions or a tab that can be removed to prevent the device from switching to record mode. For instance MiniDV cassettes have a switch which can be in one of two positions marked REC and SAVE. Placing the tab in the SAVE position guards the tape from being accidentally erased by over-recording but will not prevent damage or erasure due to careless handling, proximity to magnetic fields or poor storage conditions, etc.

Storage

Whilst it is most likely that digital video tape (e.g. DVCPRO, MiniDV) will have its write protection enabled and be designated as Master, the option exists for a Master to be created on a WORM medium or secure network storage.

If imagery stored on data tape is to be transferred to secure network storage it must be ensured that the data is in a replayable form or that the software required to access it is available and capable of reading the data from its network location. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper proof usage logs.

Network [5e]

Though not common at the time of writing it is likely that direct access to third party networks (e.g. corporate IP based CCTV systems) will be granted to the police. Images could then be retrieved directly from the third party network. The choice of copying retrieved images to a secure network or WORM media for final storage will be a matter for individual force procedure. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper-proof usage logs.

Secure police network [5f]

The term 'secure server' or secure police network should be taken to mean:

An environment, including a security management system, which is accredited to a level of at least 'RESTRICTED' under the Government Protective Marking Scheme (GPMS), in accordance with the ACPO Community Security Policy (CSP). This should be as documented in an associated Accreditation Documentation Set (ADS) and as approved by either the local Force Information Security Officer and/or the National Accreditor for Police Information Systems.

If the data is captured directly onto such a secure server (e.g. ANPR) then it can be designated 'Master' in-situ and Working Copies created as required. Master evidence not stored on WORM requires equivalent levels of protection such as access control and tamper proof usage logs.

Where detailed application specific advice is required see the relevant ACPO guidance documents.

Supplementary protection

There are various media on which images can be captured, both reusable and non-reusable. Irrespective of their nature, early transition from 'capture' to 'defining the Master' phases is extremely important. The integrity of images needs to be protected at the earliest stages as this reduces the opportunities for challenges at court.

Accidental alteration or erasure could be detected by noting image number sequences and prevented by:

- designating the image file as read only;
- activating the mechanical write protect mechanism;
- transferring to WORM media

Protection can also be achieved by controlling access to the file or media by electronic password and/or controlling the viewing of images by electronic encryption.

The Procedure does not rely on any form of 'electronic' protection but neither does it preclude its use. There are several methods for 'electronically' verifying the integrity of an image file. Once applied, any change to the pixel values will be detected although the nature and location of the changes may not be indicated.

File integrity techniques

If a 'hash' function is applied to an image, a unique numerical value is calculated for the whole image. The number is embedded in the metadata of the image file. A change in pixel value causes the 'hash' function value to change. This is the basis for most 'authentication' software. Manufacturer specific software for image integrity is becoming increasingly prevalent, as are non-destructive (i.e. fully reversible) editing techniques.

Watermarking

Watermarking describes visibly insignificant changes made to the pixel values to incorporate information which changes if the image file is altered. The watermark may then become visible on the picture or even make it unreadable.

The primary use for watermarking is to protect the intellectual property rights of the photographer or film maker. Its use may lead to claims that the image is not authentic because the pixels have been changed, therefore the use of watermarking is not recommended for image integrity.

Encryption

The image file is encrypted so that the file cannot be opened except with the correct decryption key. This has particular value if images are to be transmitted

to or from remote sites. Loss or corruption of either the key or the data may make files unrecoverable.

The use of electronic protection is mandatory in the digital imaging used for roadside cameras where there is unattended capture, the image is the only evidence of an offence having taken place and the images are transmitted from the roadside to a central facility. Refer to *Home Office and ACPO Traffic, Outline Requirements and Specification for Automated Traffic Enforcement Systems*, S Lewis, PSDB 3/96.

Handling

Images should also be protected from accidental deletion by the careful handling of media. Media should be stored in clean, dry environments and kept away from strong magnetic fields, strong light and chemical contamination.

Some media such as CDs and SmartMedia will be damaged if allowed to become dirty or scratched.

Use

The Master is defined and will be documented as such. It will then be stored securely pending its production (if required) at court as an exhibit. Only in the event of any doubt being cast on the integrity of the images will the Master be viewed.

A Working Copy is usually produced simultaneously, or immediately after the Master is defined. The Working Copy, as its name implies, is the version that will be used for investigation and to assist in the preparation of the prosecution file.

Where it is believed that images relate to any crime or incident pending civil or criminal proceedings they must be retained ensuring compliance with the *Criminal Procedure and Investigations Act 1996, the Data Protection Act 1998* and *ACPO (2006) Guidance on Management of Police Information*.

All use and movement of the Master will be logged in the audit trail. Similarly any significant use, enhancement and distribution of Working Copies should be logged. The aim is to support the presentation of evidence through legal proceedings. All audit trails should be disposed of when the image files and any analogue copies are disposed of.

Where detailed information is required reference should be made to *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 5.3 Disposal and Section 5.3.2 Disposal of Data and Audit Trail, and/or individual force procedures.

Define Master and produce Working Copy [6]

The core of the Procedure is the production, definition and storage of a Master which can be examined if required by the court to confirm the integrity of the images. The Master should be:

- labelled or named (with due care to the longevity of label and readability of medium);
- stored in a form and manner, with software if required, so that the images may be viewed in the future;
- kept in accordance with exhibit protocol;
- never used, except to make further copies together with appropriate audit trail, or by order of the court to verify integrity.

Force policies should be developed to cater for these requirements.

Image files should be in the same format as:

- received by the force in the case of third party images
- first captured on medium in/or attached to camera;
- as recorded after transmission from camera.

Still images

The first WORM copy is usually the Master.

Video images

Where video is recorded to tape, existing best practice procedures define the original tape recording as the Master. In other cases a Master needs to be defined. This can be done by:

- making two copies simultaneously and defining one as the Master and the other the Working Copy;
- making two copies, consecutively, from the HDD and defining one as the Master and the other the Working Copy;
- making one copy, the Master, and making a Working Copy from that Master.

When video is recorded to a hard disk it can be copied to secure network storage and designated as the Master. Where video sequences are stored on the HDD of a computer with no effective means of downloading the data, the computer may need to be seized in order to safeguard the data until arrangements for download or copy can be made. Any difficulties with obtaining evidential material should be referred to the force TSU or video units. Reference should be made to the *ACPO Good Practice Guide for Computer Based Evidence and Retrieval of Video Evidence and Production of Working Copies from Digital CCTV Systems*.

Produce Working Copies

Working Copies can be in many forms. The files can be copied onto any suitable medium or distributed electronically (if a secure system is in place) for circulation to the investigating officers and CPS. Issues of quality control, security and resource management need to be considered.

Where detailed information is required reference should be made to the *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 4.3 Transfer of Digital Images to the Crown Prosecution Service and/or individual force procedures.

Document and secure storage of Master [7]

The Master is defined, will be documented as such and retained in secure storage as an exhibit for court purposes.

Local force policies need to be established to ensure that the integrity of the images is maintained throughout the storage, to include the period before, during and after any court proceedings during which the images might be used.

There will be times when the Master may need to be viewed and/or a fresh Working Copy produced. Force policy needs to be developed concerning the actual process of opening the exhibit and any seal that has been used to protect the images. At present this storage is on a physical, separate piece of medium such as a tape or disk. If electronic storage on a computer system is used then equivalent procedures will need to be in place to maintain the integrity of the Master. The location and any access to the Master or movement of the Master should be recorded in the audit trail.

Whatever form the Master takes it is essential to label it adequately, protect it from physical damage and contamination and store it securely. Whether this is a room or locked cabinet it should have a clean dry atmosphere with temperature variations limited to normal room temperatures to prevent condensation. Where long-term storage is required see *Technical Issues Relating to the Storage, Replay and Disposal of Digital Evidential Images*.

Retain as exhibit [8]

The Master should be labelled, protected and stored in accordance with force procedures in order to fulfil statutory requirements.

Audit trails started at the outset of the image capture process should be completed and documented contemporaneously. A similar process may be necessary for those Working Copies that may be produced as evidence. Retention of images should conform to the Data Protection Act 1998, the Criminal Procedure and Investigations Act 1996 and *ACPO (2006) Management of Police Information*. Media containing images should be kept in a suitable environment and catalogued for accessibility.

Produce Working Copies [9]

Once the Master has been defined and stored, all use of images should be from a Working Copy. Bit-for-bit copies should be used (where possible) for further reproduction of additional Working Copies or where precise detailed analysis is to be carried out or when images are to be enhanced.

The Master should never be used, except to produce additional Working Copies when no other Working Copies are available to copy, or by order of the court to establish authenticity. Force procedures will need to detail the circumstances and the relevant processes involved. All actions will need to be entered in the audit trail.

Working Copies produced for the investigation, technical investigation, briefings, circulation, and preparation of prosecution evidence and defence can be in any of the forms described:

- Tapes or digital media in available-equipment form;
- Hard copy stills from still or video cameras;
- Edited video;
- Enhanced still or video.

The copying and distribution of Working Copies should be in accordance with force procedures with appropriate audit trails as required.

The production of copies on media such as CDs, DV tapes and prints requires specialist equipment. The copying of files within a computer is easy and so needs to be disciplined to prevent unnecessary files being produced.

It is not suggested that all Working Copies should require individual audit trails, although certain application specific situations and/or enhancement processes may require audit trails to be maintained for additional Working Copies. Where this is the case records need to be kept contemporaneously.

Where detailed information is required reference should be made to *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 4 Disclosure and Revelation to the Crown Prosecution Service and/or individual force procedures.

Prepare prosecution file [10]

Officers responsible for file preparation should:

- ensure that the Master is kept in suitable and secure conditions by the police and is made available to the prosecution or defence, upon request;
- liaise with the relevant CPS prosecutor at an early meeting to discuss the processes and capture systems used, where relevant;
- provide the CPS with full information accompanying any evidential digital images, this might include audit trails, maintenance logs, viewing logs and disclosure schedules;
- list and describe any unused and/or unviewed material clearly;
- ensure that viewing logs used for moving images highlight relevant sequences;
- provide the CPS with accurate information about the preferred format for revelation in order to reduce the loss of image quality;
- consider the format in which the image is provided to the CPS in order to facilitate viewing and replay;
- liaise with relevant departments within the CPS to ensure that viewing and replay is possible prior to trial.

Present exhibits for court [11]

All images should be presented so that evidential content is not compromised. Where possible, images should be presented in their native or original format. If there is pertinent material that can only be seen when the image is viewed in digital form then provision should be made for appropriate playback equipment to be provided in court, if these arrangements are not already in place.

It should be understood that images may look different depending on the equipment used. In particular, images viewed on different screens may appear different from one another. An accurate replay facility should be provided wherever possible.

Concerning the presentation of images in court, HOSDB is

- Liaising with the Criminal Justice System;
- Representing the police requirements to these bodies;
- Advising the Police Service on the selection of compatible hardware, software and media to facilitate effective case handling.

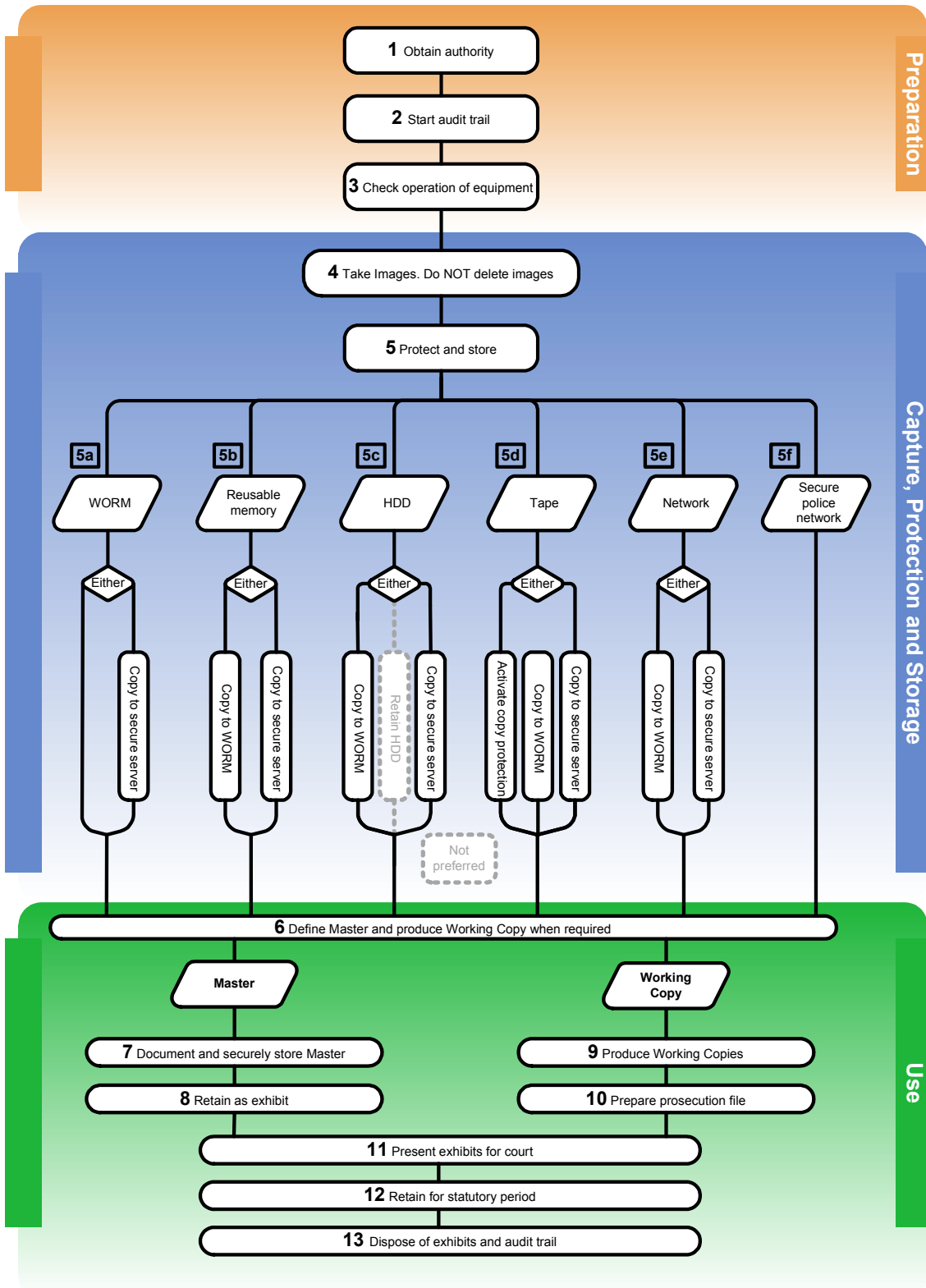
Retention and Disposal [12]

CDs, DVDs, digital tapes etc, are designed for short-to-medium term storage periods. To ensure the integrity of the data the files need to be transferred to new media regularly, possibly as often as every five years, or transferred to professionally managed data management archive systems.


Detailed advice can be found in: *ACPO (2006) Management of Police Information* and *ACPO (2007) Practice Advice on Police Use of Digital Images*, Section 5 Retention, Storage and Disposal of Images.

Dispose of exhibits and complete audit trail [13]

Each force needs to consider mechanisms for the disposal of images and complete audit trails once the statutory periods of retention are completed, in line with the principles of *ACPO (2006) Management of Police Information*.



For further explanation use accompanying notes and refer to force policy.



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