



NATIONAL ARCHIVES OF AUSTRALIA

Preservation Digitisation Standards

For the digitisation of physical RNA records

Preservation, Collection Management

Revision - February 2021

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EXECUTIVE SUMMARY

The Preservation Digitisation Standards set out the required standards for digitisation of physical records of archival value (RNA) and are designed for internal, outsourced and agency digitisation of RNA records. These standards ensure that preservation digitisation activities produce a digital copy which is an effective long-term surrogate for paper and analogue originals. They also enable the creation of derivative files to meet access requirements and minimise the physical wear and tear caused by handling fragile collection items.

The standards have been developed in line with the standards of national and international GLAM (Gallery, Library, Archive and Museum) institutions. They set out the technical requirements for digitisation outputs produced under the National Archives' National Digitisation Plan, which supports the National Digitisation and Preservation Strategies.

The preservation format for all non-audiovisual records is TIFF, with JPEG used for access derivatives. TIFF is designed to capture all the attributes of typed or written text accurately as high-quality images in a stable format and is widely supported for the digitisation of archival records. The preservation standard for audiovisual formats varies for audio, video and motion picture film, but is compliant with industry standards.

Background

The National Archives of Australia has a key responsibility to preserve and make publicly available Australian Government records that reflect our history and identity.

The National Archives' collection traces events and decisions that have shaped the nation and the lives of Australians. It includes a wide range of formats including files and documents, volumes, registers, index cards, maps, plans, charts, photographs, films, and video and audio recordings in a variety of analogue and, increasingly, many diverse digital formats.

The unique and diverse analogue collection contains formats that are physically deteriorating through use, inherently unstable, or at risk of becoming inaccessible due to the technological obsolescence of the appropriate playback equipment.

The Preservation Digitisation program ensures that Australians have continued online access to a national archival collection so they may better understand their heritage and democracy.

PURPOSE

The National Archives has a key responsibility to preserve and make publicly available the archival resources of the Commonwealth.

Preservation digitisation reduces the physical wear and tear on fragile records and is an effective tool to preserve records at risk of being lost if they are held on unstable media or subject to technological obsolescence. The creation of derivatives during the digitisation process assists the National Archives to make its collection accessible and available online to a wide and varied range of current and future users.

The Preservation Digitisation Standards set out the technical requirements for digitisation outputs produced under the National Digitisation Plan, which supports the National Digitisation and National Preservation Strategies.

The Preservation Digitisation Standards should be reviewed on an annual basis to ensure that they are in line with the standards of other national and international GLAM institutions. Digital technology is continually evolving and, to take advantage of increased capability which may enable the National Archives to digitise to a higher standard, the standards should also be reviewed, when technology emerges, industry standards changes, or when new digitisation equipment is purchased.

The Preservation Digitisation Standards are guided by the nature of our collection and the National Archives' vision to **secure, preserve and make accessible this priceless information for the benefit of current and future generations.**

The technical standards are informed by the following guiding principles to ensure that preservation digitisation activities produce a digital copy which is an effective long-term surrogate for paper and analogue originals.

The preservation digital surrogate will:

- capture a complete, accurate archival record of analogue collection items
- be preserved and accessible for the foreseeable future
- enable the re-use of the digitised content to meet known, unknown and likely current and future access requirements
- enable the creation of derivative files to meet access requirements and minimise the physical wear and tear caused by handling fragile collection items

To support these standards, supplementary guidelines and procedures will provide additional capture, handling and quality assurance requirements for each format.

Archival Master File Format (digital surrogate)

Preservation digitisation is not geared for any specific output and should be done in a use-neutral manner using a format that preserves the essential characteristics of the original records and is uncompressed or has lossless compression. The master image files produced should be usable for a wide variety of applications and outputs.

The choice of Archival Master file format for each analogue format for these standards has been based on an environmental scan of national and international cultural institutions and organisations.

TIFF is the preservation file format for all non-audiovisual records, with JPEG format utilised for access derivatives. The preservation standard for audiovisual (AV) formats varies for audio, video and motion picture film, but is compliant with industry standards.

Access File Format

The choice of access formats is dependent on the intended business use of the digital file. These derivative files are generally created as an additional product when digitising for preservation.

For paper and photographic formats, the standard provides specifications for the creation of one access copy, consisting of one JPEG file derived from the Archival Master, in line with current practices for providing access via RecordSearch.

Access copies for audiovisual formats are created on an as needs basis, as RecordSearch is not currently able to make these formats available online.

COMMENCEMENT

These standards apply to all digitisation commenced from:

- 1 January 2019: all internal proactive digitisation projects, including where outsourced
- 1 July 2019:
 - all digitisation by Australian Government agencies of material that is of archival value (RNA), including under the Agency Digitisation Service
 - on-demand digitisation undertaken by the National Archives in response to client (agency, public) demand

PRESERVATION DIGITISATION STANDARDS

1. PAPER DOCUMENTS (UNBOUND) UNDER A3

Archival documents in this category can include single folios, files and index cards. A file is a collection of documents held together in a folder. The documents within the file are often fastened together using staples, paperclips or pins. The types of documents found on a file can include:

- documents and artworks on paper
- photocopies and laser prints
- thermal papers
- maps and plans
- photographs

Documents can vary in contrast and this may affect the requirements for producing a clear quality digital image. Documents with a well-defined print type with a high level of contrast between the ink and paper and with no discolouration or staining of the paper substrate can be scanned in 8-bit colour. Older documents, with handwritten annotations, poor legibility and low contrast between the text and paper, or where the substrate is faded or stained, should be scanned at a higher bit rate of 16-bit colour.

Files containing multiple documents will be digitised to single page TIFF files, not to a multi-page TIFF.

Any photographic negatives and transparencies attached to, or found within, files and documents should also be digitised using the photographic digitisation standards in this document.

1.1 Paper documents under A3

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Paper documents under A3	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	400 ppi	300 ppi
Bit Depth	8 bit colour (24 bit)	8 bit colour (24 bit)

Colour space	sRGB or Adobe RGB	sRGB
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2. LARGE FORMAT PAPER DOCUMENTS (UNBOUND) OVER A3

(Including maps, plans and large format records)

Records larger than A3 cannot fit easily onto a standard flatbed scanner. This may include document types such as maps, charts, architectural and engineering drawings, posters or other large handwritten, typed or printed documents.

Many of these formats contain fine details. Where there is very fine detail, a higher scanning resolution of 600 ppi may be required to produce a more legible image.

Due to their larger dimensions, the scanning of oversize images can produce very large file sizes.

Do not leave oversized records in scanning equipment unattended or unsupported as this can lead to damage.

Oversized materials, including books that have foldouts, must be scanned using equipment that features a scanning bed that is as large, or larger than the item to be scanned.

Do not place glass or other transparent material directly on top of fragile artwork, documents, manuscripts, prints, photographs, with or without mounts, as this can cause media to crack or to detach from the item. Use spacers on fragile items to prevent compression between an item and a glass plate.

2.1 Documents over A3 (including maps, plans and large format records)

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Documents over A3 (including maps, plans and large format records)	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	400 ppi	3000 pixels shortest edge
Bit Depth	8 bit colour (24 bit)	8 bit colour (24 bit)
Colour space	sRGB or Adobe RGB	sRGB

2.2 Rare or significant documents, artworks, posters or large format records with a high level of detail

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Rare or significant documents, artworks, posters or large format records with a high level of detail	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	600 ppi	3000 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	Adobe RGB or ProPhoto RGB	sRGB

3. BOUND VOLUMES

The term volume refers to an item in the form of a bound book. Volumes may be bound in a variety of styles and materials to protect the pages inside. Types of binding styles found in archival collections may include:

- case bindings where the cover is made separately and wrapped around the text block
This can include fine, decorative or limited-edition volumes, logbooks and diaries
- large leather or suede bound 19th century ledgers and registers
- simple do-it-yourself bindings such as comb or spiral bindings used for business and government reports, diaries and one-off documents
- loose-leaf binders and folders that allow individual leaves to be easily added or exchanged
- post bindings, which use a number of metal posts or screws to hold the binding and the text block together

Handling issues

Flatbed scanners are not recommended for bound volumes. Pressure should not be applied to books in order to flatten them for image capture as this can break the spine or loosen or break off brittle pages in a book.

Books with weak joints or restricted openings should be placed in a book cradle (blocks or rolls of polyethylene foam) during image capture.

Scanning equipment must be adjustable to the height of the collection item to accommodate books that need cradle support.

3.1 Bound Volumes

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Bound Volumes	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	400 ppi	300 ppi
Bit Depth	8 bit colour (24 bit)	8 bit colour (24 bit)
Colour space	sRGB or Adobe RGB	sRGB

4. PHOTOGRAPHIC PRINTS AND NEGATIVES

Photographic records contain an image formed in a binder layer on paper, resin coated paper, cellulose acetate, cellulose nitrate or polyester base. Black-and-white images are formed by metallic silver particles and colour images by dye layers. In the National Archives' collection, the binder layer most commonly consists of a gelatine emulsion; early processes can also be albumen or collodion. Photographic print images are on a paper (occasionally plastic) base, and negatives or positive transparencies have a clear plastic or sometimes glass base.

Nitrate and acetate-based negatives are prone to deterioration of both the image and base layer. This deterioration can be slowed significantly by storing negatives at low temperature and relative humidity. The only other practical way to preserve the images and make them accessible is to digitise them.

For the purposes of preservation digitisation, the photographic collection can be grouped in the categories below:

Prints:

- Colour and black-and-white photographic prints – smaller than A6 (10 x 15cm)
- Colour and black-and-white photographic prints – A6 to A4 (10 x 15cm to 21x30cm)
- Colour and black-and-white photographic prints – over A4 (over 21x30cm)

Transparent materials such as glass can be used to hold the edge of an image flat during digitisation, but care must be taken that the original is not harmed while under pressure. Tightly curled materials must not be forced to lay flat. Care must be taken to assure that flattening a photograph will not result in emulsion cracking, or the base material being damaged.

Negatives and transparencies (including glass plate negatives and positives):

- Colour and black-and-white negatives and transparencies – up to 35mm
- Colour and black-and-white negatives and transparencies – up to 6x6cm
- Colour and black-and-white negatives and transparencies – up to 4"X5"
- Colour and black-and-white negatives and transparencies – over 4"X5" and up to 5"X7"
- Colour and black-and-white negatives and transparencies – over 5"X7" and up to 8"X10"

If using a high-end digital camera, the use of a 5000K light box and calibrated viewing environment is critical when scanning negatives and transparencies. The camera must also capture enough detail to visually resolve the desired ppi. For overhead camera capture fixed focal length, flat field macro lenses must be used. The camera should be capable of capturing at least 14 stops of dynamic range to ensure adequate detail in shadows and highlights.

The initial raw scan of a negative captures all of the information required for a preservation digital surrogate. To make the image accessible, the raw scan is inverted to create a positive image with some adjustments. This may include applying curves to increase or lower contrast and or shadows and highlights for an evenly exposed positive. Image may also be flipped depending on the capture method. For example, if capturing emulsion side up using an

overhead camera setup the image must be flipped to show the “right” side. We retain both the raw file and the inverted master file as archival masters.

Film Targets

The use of a film target is essential in determining aim point values for shadows and highlights to ensure no tonal clipping occurs during capture. The film target also allows for correcting white balance and offers optical resolution charts to check for sharpness and focus. Using targets as a reference will provide evidence of consistency and accuracy making it easier to control quality ensuring negatives and prints have been digitised to the same standard.

The RGB/LAB values for the target patches on the digital image should match the values provided from the supplier of that particular target or match values of that target measured from a spectrophotometer, but in general the target should have the following values

- White – ~240-245 RGB
- Mid Grey – ~110-115 RGB
- Black – ~12-20 RGB

The surrounding space should be around ~250 RGB

Handling issues

Glass plate negatives may not be put under pressure. They are not always perfectly flat or may have hairline cracks, resulting in breakage when pressure is applied.

PHOTOGRAPHIC PRINTS (COLOUR AND B&W)

4.1 Colour and black-and-white photographic prints – smaller than A6 (10 x 15cm)

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Colour and black-and-white Photographic Prints - Smaller than A6 (10 x 15cm)	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	2700 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	Adobe RGB or ProPhoto RGB	sRGB

4.2 Colour and black-and-white photographic prints – A6 to A4 (10 x 15cm to 21x30cm)

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Colour and black-and-white Photographic Prints - A6 to A4 (10 x 15cm to 21x30cm)	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	900 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	Adobe RGB or ProPhoto RGB	sRGB

4.3 Colour and black-and-white photographic prints – over A4 (over 21x30cm)

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Colour and black-and-white Photographic Prints – Over A4 (over 21x30cm)	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	600 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	Adobe RGB or ProPhoto RGB	sRGB

PHOTOGRAPHIC NEGATIVES AND TRANSPARENCIES (COLOUR AND BLACK AND WHITE)

4.4 Colour negatives and transparencies – up to 35mm

Archival Master – Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Colour negatives and transparencies – up to 35mm		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	4000 – 5000 ppi	4000 - 5000 ppi	1290 pixels shortest edge
Preferred Resolution	5000 ppi	5000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	ProPhoto RGB	ProPhoto RGB	sRGB

4.5 Black-and-white negatives and transparencies – up to 35mm

Archival Master – Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Black-and-white negatives and transparencies – up to 35mm		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF6.0	JPEG
Manipulation	None no cropping	Inverted to positive with adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	4000 – 5000 ppi	4000 - 5000 ppi	1290 pixels shortest edge
Preferred Resolution	5000 ppi	5000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16bit	8 bit
Colour space	ProPhoto RGB	Grey Gamma 2.2	Grey Gamma 2.2

4.6 Colour negatives and transparencies – up to 6X6cm

Archival Master – Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Colour negatives and transparencies – up to 6X6cm		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	3000 - 4000 ppi	3000 - 4000 ppi	1290 pixels shortest edge
Preferred Resolution	4000 ppi	4000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	ProPhoto RGB	ProPhoto RGB	sRGB

4.7 Black-and-white negatives and transparencies – up to 6X6cm

Archival Master – Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Black-and-white negatives and transparencies – up to 6X6cm		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	3000 - 4000 ppi	3000 – 4000 ppi	1290 pixels shortest edge
Preferred Resolution	4000 ppi	4000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16bit	8 bit
Colour space	ProPhoto RGB	Grey Gamma 2.2	Grey Gamma 2.2

4.8 Colour negatives and transparencies – up to 4”X5”

Archival Master – Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Colour negatives and transparencies – up to 4”X5”		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	2000 – 3000 ppi	2000 – 3000 ppi	1290 pixels shortest edge
Preferred Resolution	3000 ppi	3000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	ProPhoto RGB	ProPhoto RGB	sRGB

4.9 Black-and-white negatives and transparencies – up to 4”X5”

Archival Master – Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Black-and-white negatives and transparencies – up to 4”X5”		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None No cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	2000 – 3000 ppi	2000 – 3000 ppi	1290 pixels shortest edge
Preferred Resolution	3000 ppi	3000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16bit	8 bit
Colour space	ProPhoto RGB	Grey Gamma 2.2	Grey Gamma 2.2

4.10 Colour negatives and transparencies – over 4”X5” and up to 5”X7”*Archival Master – Capture ratio 100% with no manipulation*

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Colour negatives and transparencies – over 4”X5” and up to 5”X7”		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	1100 – 3000 ppi	1100 ppi - 3000	1290 pixels shortest edge
Preferred Resolution	3000 ppi	3000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	ProPhoto RGB	ProPhoto RGB	sRGB

4.11 Black-and-white negatives and transparencies – over 4”X5” and up to 5”X7”*Archival Master – Capture ratio 100% with no manipulation*

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Black-and-white negatives and transparencies – over 4”X5” and up to 5”X7”		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Minimum Resolution	1100 - 3000 ppi	1100 - 3000 ppi	1290 pixels shortest edge
Preferred Resolution	3000 ppi	3000 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16bit	8 bit
Colour space	ProPhoto RGB	Grey Gamma 2.2	Grey Gamma 2.2

4.12 Colour negatives and transparencies – up to 8”X10”*Archival Master – Capture ratio 100% with no manipulation*

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Colour negatives and transparencies – up to 8”X10”		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable range	800 – 1600 ppi	800 – 1600 ppi	1290 pixels shortest edge
Preferred Resolution	1600 ppi	1600 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16 bit colour (48 bit)	8 bit colour (24 bit)
Colour space	ProPhoto RGB	ProPhoto RGB	sRGB

4.13 Black-and-white negatives and transparencies – up to 8”X10”*Archival Master – Capture ratio 100% with no manipulation*

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Black-and-white negatives and transparencies – up to 8”X10”		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Acceptable Range	800 - 1600 ppi	800 - 1600 ppi	1290 pixels shortest edge
Preferred Resolution	1600 ppi	1600 ppi	1290 pixels shortest edge
Bit Depth	16 bit colour (48 bit)	16 bit	8 bit
Colour space	ProPhoto RGB	Grey Gamma 2.2	Grey Gamma 2.2

5. AERIAL FILM AND PHOTOGRAPHS

Aerial film and photographs form a sub-category of the National Archives' photographic collection. An aerial photograph is a photograph of the ground taken from an elevated position, usually from the air or sky. Aerial photographs provide a straightforward depiction of the physical and cultural landscape of an area at a given point in time. Aerial photographs in particular have fine detail, often require a high degree of enlargement, and may require a higher degree of precision regarding the dimensional accuracy when digitised.

The use of an approved 'film winder' is essential for digitisation activity on wound roll aerial film.

A suitable very high-resolution digital camera is used in conjunction with a flashbox light box and a film winder.

For the purposes of preservation digitisation, the aerial photographic collection can be grouped in the below categories:

- aerial prints – up to 8"x10"
- aerial prints – over 8"x10"
- aerial film – 70mm, 127mm roll film and medium format roll film
- aerial film – 4 x 5 and up to and including 5 x 7 sheet film
- aerial film – larger than 127mm roll film/ larger than 5 x 7 sheet film
- glass plates

5.1 Aerial Prints – Up to 8"x10"

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Aerial Prints - up to 8"x10"	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	900ppi	1500 pixels shortest edge
Bit Depth	16 bit (48 bit) colour	8 bit (24 bit) colour
Colour space	ProPhoto RGB	sRGB

5.2 Aerial Prints – over 8"x10"

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Aerial Prints – over 8"x10"	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	900 ppi	1500 pixels shortest edge
Bit Depth	16 bit (48 bit) colour	8 bit (24 bit) colour
Colour space	ProPhoto RGB	sRGB

5.3 Aerial film – 70mm, 127mm roll film and medium format roll film

Archival Master - Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Aerial film – 70mm, 127mm roll film and medium format roll film		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	1588 - 2540 ppi	1588 - 2540 ppi	1500-pixels shortest edge
Spatial Resolution	16.0 – 10.0 µm	16.0 – 10.0 µm	
Bit Depth	16 bit (48 bit) colour	16 bit (48 bit) colour	8 bit (24 bit) colour
Colour space	ProPhoto RGB	Grey Gamma 2.2 (B&W) ProPhoto RGB (colour)	Grey Gamma 2.2 (B&W) sRGB (colour)

5.4 Aerial film - 4 x 5 and up to and including 5 x 7 sheet film*Archival Master - Capture ratio 100% with no manipulation*

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Aerial film - 4 x 5 and up to and including 5 x 7 sheet film		
Purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None no cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	1588 - 2540 ppi	1588 - 2540 ppi	1500-pixels shortest edge
Spatial Resolution	16.0 - 10.0 μm	16.0 - 10.0 μm	
Bit Depth	16 bit (48 bit) colour	16 bit (48 bit) colour	8 bit (24 bit) colour
Colour space	ProPhoto RGB	Grey Gamma 2.2 (B&W) ProPhoto RGB (colour)	Grey Gamma 2.2 (B&W) sRGB (colour)

5.5 Aerial film - Larger than 127mm roll film/ larger than 5 x 7 sheet film

Archival Master - Capture ratio 100% with no manipulation

Derivative	Raw Digital surrogate	Archival Master Digital surrogate	Derivative 1
Format type	Aerial film - Larger than 127mm roll film/ larger than 5 x 7 sheet film		
File name an purpose	Preservation	Preservation	Access
File Type	DNG	TIFF 6.0	JPEG
Manipulation	None No cropping	Inverted to positive with some adjustments	Derived from Archival Master
Compression	uncompressed	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	1588 – 2540 ppi	1588 – 2540 ppi	1500-pixels shortest edge
Spatial Resolution	16.0 - 10.0 µm	16.0 - 10.0 µm	
Bit Depth	16 bit (48 bit) colour	16 bit (48 bit) colour	8 bit (24 bit) colour
Colour space	ProPhoto RGB	Grey Gamma 2.2 (B&W) ProPhoto RGB (colour)	Grey Gamma 2.2 (B&W) sRGB (colour)

6. X-RAY FILM (RADIOGRAPHS)

X-ray film, like B&W photographic film, consists of a silver image formed in a gelatine emulsion on a transparent cellulose nitrate or acetate base. X-rays have the same deterioration characteristics, preservation and storage issues as other film-based photographic materials.

Few scanners are capable of imaging radiographs properly due to their very wide density range and large size. There are specialized film scanners built for this application.

6.1 X-ray Film

Archival Master - Capture ratio 100% with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	X-Ray Film (Radiographs)	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	uncompressed	JPEG compression Photoshop Level 10-12
Resolution	5000 ppi	1000 pixels longest edge
Bit Depth	16bit	8 bit
Colour space	Grey Gamma 2.2	Grey Gamma 2.2

7. MICROFORMS

Microform is the term used to cover a range of photographic media employed to copy documents. It includes microfilm, microfiche and aperture cards. A master microfilm is usually black and white silver halide film made from original records. It is used to produce reference copies using less expensive, more robust but less archival dye-based processes on Diazo Film, or a Vesicular Film which produces a positive image (if copied from a negative film) with 10-20 years archival life. Microfilm readers are then used to view or digitise the reference copies.

For the purposes of preservation digitisation, the microfilm collection can be grouped in the below categories:

- 16mm and 35mm Microfilm
- Aperture Card - mainly produced with a single frame of 35mm film mounted within the open aperture.
- Microfiche - come in a variety of formats, standard size is 105 mm by 148 mm

Due to photographic limitations of microfilm and the variable quality of older microfilm, it may not be possible to produce what would normally be considered reproduction quality image files. The choice of scanning approach may vary from the recommendations for textual records, and may be more focused on creating digital images with reasonable legibility.

Digital reproductions should be made from a preservation copy of microfilm, if available.

Crop to include the visible edge of pages.

If technical targets are not present on the Microfilm the reduction/scale can be estimated, based on text size and type of document captured. The estimated size/scale of the original document on the Microfilm can then be used to work out the 100% capture Resolution.

7.1 Microfilm, Microfiche, Aperture card

Archival Master - Capture ratio 100% of original document size (or best estimate), with no manipulation

Derivative	Archival Master Digital surrogate	Derivative 1
Format type	Microfilm, Microfiche, aperture card	
Purpose	Preservation	Access
File Type	TIFF 6.0	JPEG
Compression	none	JPEG compression Photoshop level 10-12
Resolution	400 ppi	400 ppi
Bit Depth	8 bit	8 bit
Colour space	Grey Gamma 2.2	Grey Gamma 2.2

8. AUDIO FORMATS

The specifications apply to all physical audio formats including:

- compact cassette
- micro cassette
- mini cassette
- ¼" open reel tape
- gramophone discs
- digital audio tape (DAT)
- CD audio
- 16 mm, 17.5 mm and 35 mm magnetic or optical motion picture film sound.

For audio digitisation the National Archives follows the standards, practices and strategies detailed in the publication: International Association of Sound and Audiovisual Archives (IASA) – Guidelines on the Production and Preservation of Digital Audio Objects (IASA TC-04 Second Edition, 2009). <https://www.iasa-web.org/tc04/audio-preservation>

The number of audio channels should always be based on the format of the original item, rather than the recorded signal. For example, a single microphone recorded on a stereo cassette recorder will have a mono signal but the format is stereo so playback and the copy should be stereo.

8.1 Analogue formats (for example Gramophone disc, ¼ inch tape, compact or micro cassette and magnetic or optical motion picture film sound)

Derivative	Archival Master Digital surrogate	Derivative 1 small
Format type	Analogue formats (e.g. Gramophone disc, ¼ inch tape, compact or micro cassette and magnetic or optical motion picture film sound)	
Purpose	Preservation	Access
File Type	BWF	mp3 (MPEG-2 Layer III)
Encoding	LPCM (Linear Pulse Code Modulation)	
Sampling frequency	96 kHz	48kHz
Bit Depth/rate	24-bit	192kbit/s CBR
Audio Channel	Same as original	Same as original

8.2 Digital formats (for example DAT)

Derivative	Archival Master Digital surrogate	Derivative 1 small
Format type	Digital formats (e.g. DAT)	
Purpose	Preservation	Access
File Type	BWF	mp3 (MPEG-2 Layer III)
Encoding	LPCM (Linear Pulse Code Modulation)	
Sampling frequency	Same as original	Same as original
Bit Depth	Same as original	192kbit/s CBR
Audio Channel	Same as original	Same as original

9. VIDEO FORMATS

The specifications apply to all physical video formats containing video, including:

- One Inch, Two Inch
- VHS
- Betamax, Betacam, Betacam SP, Betacam SX, Betacam HD, Digital Betacam
- Video 8
- EIAJ Open Reel, EIAJ Cartridge
- Hi 8
- Umatic
- D2
- Mini DV
- DV Cam, XD Cam, HD Cam
- Laserdisc.

For video digitisation the operator must confirm that the aspect ratio is the same as the original, that there is accurate sync between audio and video, and that the preservation file copy displays the same interlacing as the original source tape.

The National Archives is currently reviewing the International Association of Sound and Audiovisual Archives (IASA) – Guidelines for the Preservation of Video Recordings (TC 06) which had its initial release in 2018.

9.1 High definition video

Derivative	Archival Master Digital surrogate	Derivative 1 small
Format type	High definition video	
Purpose	Preservation	Access
File type	MFX OP-1a	MPEG 4 Base Media / Version 2
Video codec	MJPEG2000 lossless compression encoding	AVC High@L4.0
bit depth/rate	10 bit - VBR	8 bit - 5Mb/s CBR
Frame size	Same as original	Same as original
Frame rate	Same as original	Same as original
Colour space	Same as original	YUV
Chroma subsampling	Same as original	4:2:0
Audio stream	BWF 48 kHz, 16 bit PCM encoding	48 kHz, 8 bit AAC,125kbps

9.2 Standard definition video

Derivative	Archival Master Digital surrogate	Derivative 1 small
Format type	Standard definition video	
Purpose	Preservation	Access
File type	MFX OP-1a	MPEG 4 Base Media / Version 2
Video codec	MJPEG2000 lossless compression encoding	AVC High@L3.0
bit depth/rate	10 bit - VBR	8 bit - 1.5Mb/s CBR
Frame size	PAL – 720 x 576 NTSC - 720 x 486	PAL – 720 x 576 NTSC - 720 x 486
Frame rate	PAL – 25fps NTSC - 29.97fps	PAL – 25fps NTSC - 29.97fps
Colour space	YUV	YUV
Chroma subsampling	4:2:2	4:2:0
Audio stream	BWF 48 kHz, 16 bit PCM encoding	48 kHz, 8 bit AAC,125kbps

10. MOTION PICTURE FILM

Motion picture film held at the National Archives is predominantly on 8mm, 16mm and 35mm gauges. Motion picture film consists of a gelatine emulsion on a plastic support base of cellulose nitrate, cellulose acetate or polyester. The image is formed in the emulsion layer from colour dyes or silver halide particles.

Motion picture film is prone to deterioration due to degradation of the inherently unstable film base. Colour film is also prone to dye fade. Deterioration can be slowed by storing film at low temperature and relative humidity. The National Archives also preserves film through digitisation to industry standard digital file types.

The specifications in this document apply to all physical motion picture film formats including:

- 8mm, 16mm and 35mm positive and negative film
- Super 8mm, Super 16mm and Super 35mm film .

Motion picture films intended for theatre projection will have been recorded at 24 frames per second, whereas those intended for television will be 25 frames per second. It is important that the film is scanned at the correct frame rate and that magnetic or optical film sound is preserved at its original recorded speed.

10.1 Super 35mm and 35mm positive and negative film

Derivative	Archival Digital Master	Derivative 1
Format type	35mm and Super 35mm positive and negative film	
Purpose	Preservation	Access
File type	DPX (SMPTE-268 2003) uncompressed	MPEG 4 Base Media / Version 2
Video codec		AVC High@L4.0
Resolution	4096 x 2160 - 3072 (4K) or 5120 x 3840 (5k)	1920x1080 (HD)
Bit depth/rate	10Bit	8 bit - 5Mbps CBR
Chroma subsampling	4:4:4	4:2:0
Colour space	RGB	YUV
Audio stream	BWF 48 kHz, 24 bit PCM encoding	48 kHz, 8 bit AAC,125kbps
Frame rate	24fps	24fps

10.2 16mm positive film 24fps

Derivative	Archival Digital Master	Derivative 1
Format type	16mm positive film	
Purpose	Preservation	Access
File type	DPX (SMPTE-268 2003) uncompressed	MPEG 4 Base Media / Version 2
Video codec		AVC High@L4.0
Resolution	2048x1556 (2K)	1920x1080 (HD)
Bit depth/rate	10Bit	8 bit - 5Mbps CBR
Chroma subsampling	4:4:4	4:2:0
Colour space	RGB	YUV
Audio stream	BWF 48 kHz, 24 bit PCM encoding	48 kHz, 8 bit AAC,125kbps
Frame rate	24fps	24fps

10.3 16mm positive film 25fps (kine, telerecordings)

Derivative	Archival Digital Master	Derivative 1
Format type	16mm positive film	
Purpose	Preservation	Access
File type	DPX (SMPTE-268 2003) uncompressed	MPEG 4 Base Media / Version 2
Video codec	Uncompressed	AVC High@L4.0
Resolution	1920x1080 (HD) or 2048x1556 (2K)	1920x1080 (HD)
Bit depth/rate	10 bit	8 bit - 5Mbps CBR
Chroma subsampling	4:2:2 or 4:4:4	4:2:0
Colour space	RGB	YUV
Audio stream	BWF 48 kHz, 16 bit PCM encoding	48 kHz, 8 bit AAC,125kbps
Frame rate	25fps	25ps

10.4 16mm negative and Super 16mm negative film

Derivative	Archival Digital Master	Derivative 1
Format type	16mm negative and Super 16mm negative film	
Purpose	Preservation	Access
File type	DPX (SMPTE-268 2003) uncompressed	MPEG 4 Base Media / Version 2
Video codec		AVC High@L4.0
Resolution	4096x2970 (4K) or 2048x1556 (2K)	1920x1080 (HD)
Bit depth/rate	10 Bit	8 bit - 5Mbps CBR
Chroma subsampling	4:4:4	4:2:0
Colour space	RGB	YUV
Audio stream	BWF 48 kHz, 24 bit PCM encoding	48 kHz, 8 bit AAC,125kbps
Frame rate	As per original 24fps or 25ps	As per original 24fps or 25ps

10.5 Super 8mm and Standard 8mm positive and negative film

Derivative	Archival Digital Master	Derivative 1
Format type	Super 8mm and Standard 8mm positive and negative film	
Purpose	Preservation	Access
File type	DPX (SMPTE-268 2003) uncompressed	MPEG 4 Base Media / Version 2
Video codec		AVC High@L4.0
Resolution	2048x1556 (2K)	1920x1080 (HD)
Bit depth/rate	10 Bit	8 bit - 5Mbps CBR
Chroma subsampling	4:4:4	4:2:0
Colour space	RGB	YUV
Audio stream	BWF 48 kHz, 24 bit PCM encoding	48 kHz, 8 bit AAC,125kbps
Frame rate	As per original	As per original

GLOSSARY

Access File Format	A derivative file created at the same time or from the Archival Master file. The format is dependent on intended use. As it is not an archival format it can be compressed.
Archival Master File	The Archival Master preserves the essential characteristics of the original records and is uncompressed or has lossless compression.
Audio Channel	A single stream of recorded sound with a location in a sound field or a signal that has been stored on media.
AVC High	<p>Advanced Video Coding (H.264 or MPEG-4 Part 10 AVC) is a motion-compensation based video compression standard. As of 2014, it is one of the most commonly used formats for the recording, compression, and distribution of video content.</p> <p>The standard defines a set of capabilities, which are referred to as <i>profiles</i>, targeting specific classes of applications. This allows a decoder to recognise the requirements to decode that specific stream. The HIGH profile is primary profile for broadcast and disc storage applications.</p>
AVI	Audio-Video Interleave – a file type developed by Microsoft which combines audio and video with varying degrees of resolution and compression.
Bit depth	The number of bits used to represent each pixel in an image or the total number of bits used multiplied by the number of colour channels.
Chroma subsampling	Chroma subsampling is the practice of encoding images by implementing less resolution for chroma information than for luma information, taking advantage of the human visual system's lower acuity for colour differences than for luminance.
Codec	A codec is a software or hardware application that compresses and decompresses data, combining the functions of an encoder and decoder.

Colour space	A geometric representation of colours in space that can be visually perceived or generated using a particular colour model such as RGB or CMYK.
Complete archival record	An archival record is considered complete, when it a whole, legible and accurate representation of the record. This means that all pages, attachments, annotations and enclosures are captured. There is no information missing or obscured through redaction, cropping or any other means.
Compression	Re-encoding data so that it reduces the amount of information required compared to the same data uncompressed. May be lossy or lossless.
Derivative	Derivative files are secondary items produced from the master file. An access file is considered to be a derivative file.
DPX (SMPTE-268 2003) uncompressed	Digital Picture Exchange (DPX) is a common file format for digital intermediate and visual effects work as defined by the SMPTE standard (268M-2003).
Encoding	A system that modifies a signal prior to recording. Encoding is the process of converting data from one form to another.
Frame rate	Frame rate is expressed in frames per second or fps. It is the rate at which continuous still images (frames) appear on a display.
JPEG	JPEG is a commonly used method of lossy compression for digital images.
MXF OP-1a	Material Exchange Format (MXF) is a container format for professional digital video and audio media defined by a set of SMPTE standards which supports a number of different streams of coded video and audio formats, together with metadata which describes the material contained within the MXF file.
MJPEG2000	Motion JPEG 2000 (MJ2 or MJP2) is a file format for motion sequences of JPEG 2000 images and associated audio, based on the MP4/QuickTime format.

MPEG 4 Base Media / Version 2

MPEG-4 is a method of defining compression of audio and visual digital data. It was introduced in late 1998 and designated a standard for a group of audio and video coding formats and related technology agreed upon by the ISO/IEC Moving Picture Experts Group (MPEG) under the formal standard ISO/IEC 14496.

MPEG-4 provides a large and rich set of tools for encoding. Subsets of the MPEG-4 tool sets have been provided for use in specific applications. These subsets, called 'Profiles', limit the size of the tool set a decoder is required to implement.

NTSC

Broadcasting system used in North America, Canada and the Middle East.

PAL

Broadcasting system used in Australia, New Zealand and other countries.

PDF

Portable Document Format (PDF) is a file format developed by Adobe, used to present and exchange documents, independent of software, hardware, or operating system. PDF is now an open standard maintained by the International Organization for Standardization.

PDF/A

PDF/A is an ISO-standardised version of the Portable Document Format (PDF). PDF/A differs in that it has been developed for archiving and the long-term preservation of **electronic** documents. Features present in PDF unsuitable for long-term archiving have been removed.

Raw file

An uncompressed, unprocessed file originating directly from the camera or scanning equipment.

Resolution

This term can describe either how many pixels a monitor can display or how fine a printer can print.

RGB

The RGB colour model is an additive colour model in which red, green and blue light are used to produce a wide range of colours.

Sampling frequency

The frequency (or rate) at which an analogue signal is sampled

TIFF

Tagged Image File Format – is a popular format for storing raster image data and is specified in TIFF Revision 6.0 from Adobe Systems. It has the ability to store image data in a lossless format.

YUV

The YUV model defines a colour space in terms of one luma (Y) and two chrominance (UV) components. The YUV colour model is used in the PAL composite colour video standard. Previous black-and-white systems used only luma (Y') information. Colour information (U and V) was added separately via a sub-carrier so that a black-and-white receiver would still be able to receive and display a colour picture transmission in the receiver's native black-and-white format.