Preservation Digitization for Photographs

Sunday April 24th - Monday April 25th, 2005
National Archives Building, Washington DC

Background Information

Goals:

- Define preservation digitization in comparison to production masters.
- Apply technical decisions made for preservation digitization of photographs to other types of originals – text.
- Published as a DLF document – want consensus within the broader community.

Scope:

Guidelines for preservation digitization of the following-

- Analog photographs viewed by or used with transmission and reflection illumination.
- First generation camera originals and all generations of prints, copies, and duplicates.
- Positive and negative tone orientation images.
- Black-and-white, monochome, and color.

Excludes - inkjet prints, laser (electrophotographic) prints, and other halftone or dot based images.

Perspectives that Influence Decisions Regarding Preservation Reformatting:

Institutional and User Perspective		Original Resource Perspective
Use Sustainability Affordability	Source Characteristics Purpose/People Technology Capabilities	Fidelity Functionality Longevity
Needs and desires.		Past preservation reformatting, particularly duplication of photographic negatives.
From Steve Chapman's "Microfilm: A Preservation Technology for the 21st Century?"	From Paul Conway's "Overview: Rationale for Digitization and Preservation" - http://www.nedcc.org/digital/ii.htm	From Steven Puglia's reformatting pyramid chart

When determining the need for preservation reformatting – need to assess risk and prioritize based on –

Use
Deterioration
Obsolescence
Complexity

Need to evaluate-

Institutional needs

Assess originals for –

Risk
Condition
Generation/copies
Worth/value
Quantity
Cohesiveness of collection
Institutional context
Mission
Comprehensiveness

Other Requirements to be Met in Order to be Considered Preservation Reformatting:

Metadata –

Must have sufficient information about –

Original resource
Digital resource
Persistent identification
Audit trail – what has been done to the digital resource
Provenance
Rights – including must have the right to preserve
Digital resource and associated metadata must be in a managed environment.
Digital repository
Fixity
Authenticity

Other Considerations, Thoughts, and Recommendations:

Currently, it is still cheaper and lower risk to store photographic originals in the proper environment, such as cold storage for acetate film and color originals.

Only at the highest technical quality level do you get a digital resource that matches the photographic original.

We encourage institutions to keep photographic originals and to continue with all necessary and appropriate preservation efforts.

One problem with trying to digitize for preservation reformatting is high-end flatbed scanners designed for the prepress market are disappearing due to the continuing trend for direct digital capture using digital cameras – so it will be hard to get scanning equipment capable of meeting preservation digitization requirements.

We encourage institutions, while it is still a viable option, to take advantage of photographic duplication and copying for preservation reformatting of deteriorating photographic originals.

If all the requirements described in this document are met, we are willing to consider digital copies as preservation surrogates.

Technical Requirements:

Approach should be "use neutral." Propose three quality levels-

Concept for Levels

1	2	3
Practical Reproduction / Use Needs	Reproduce Scene Detail Captured by Photographic Original	Ideal Reproduce the Photographic and Physical Properties / Characteristics of the Photographic Originals
Achievable using currently available equipment.	Currently, difficult to do for some originals – Not all equipment will produce files to required quality levels. Very large files.	Not doable today. Direction to push imaging and digital library communities.
Modification of NARA's current recommendations for production master files. Guestimated as appropriate for up to 95% of reproduction needs.	Scene focused – record detail as captured on the photographic source. Select quality levels appropriate for 90% of originals? Tremendous variation in originals. General technical approach same as "Reproduction / Use Needs" metric, with higher spatial resolution during image digitization.	Photographic original focused – record all the photographic and physical properties/characteristics of the photographic source. Multi-spectral imaging? Highest spatial resolution for image digitization to record the micro-detail of photographic source, including photographic grain.

May not capture – All the scene detail as captured by the photographic source. Particularly for larger-format camera originals. For many originals – Will not capture all the properties/characteristics of the photographic source. Photographic grain structure. Micro detail.	For some originals – May not capture all the properties/characteristics of the photographic source. Photographic grain structure. Micro detail.	

Technical Requirements

1	2	3
Practical Reproduction / Use Needs	 Reproduce Scene Detail Captured by Photographic Original	Ideal Reproduce the Photographic and Physical Properties / Characteristics of the Photographic Originals
Capture and save in high-bit mode – 48-bit RGB or for some originals 16-bit grayscale. Specify color mode and define appropriate tone and color reproduction. LAB mode – density linear to lightness and matched to two fixed density ranges (2.0 and 4.0)? Use resolution requirements from NARA Guidelines? Should resolution be higher? Alternative minimum? If so, what should it be? At least 4,000 lines? Other modifications?	Capture and save in high-bit mode – 48-bit RGB or for some originals 16-bit grayscale. Specify color mode and define appropriate tone and color reproduction. LAB mode – density linear to lightness and matched to two fixed density ranges (2.0 and 4.0)? Scan transmissive camera originals at – 3,000 to 4,000 ppi 2,000 ppi for larger originals? Scan reflective second-generation originals at – 400 to 600 ppi 800 ppi for contact printed and higher resolution print materials? Other modifications?	Highest spatial resolution for image digitization to record the micro-detail of photographic source, including photographic grain. Multi-spectral imaging?

Topics to be Discussed:

Performance of capture devices -

- OECF
- Dynamic range
- SFR

Noise –

- Is current limit OK?
- Is a lower limit practical?

Channel registration –

- Is current limit OK?
- Is a lower limit practical?
- Uniformity
- Dimensional accuracy
- Other?

Tone orientation – positive digital image (same tone orientation as original) or negative digital image (inverted tone orientation compared to the original)

Will tone orientation of digital image vary depending on originals?

Photographic positives – prints, transparencies, slides, lantern slides, etc.

Photographic negatives

Color mode
Encoding
RGB
LAB
Other - ?

Signal resolution – assume high-bit capture and storage.
Spatial resolution – for reference, see comparison charts below.

Tone reproduction.

- Color reproduction.
- Color management – ICC process?
- Color space
- Input referred
- Accurate if profile is ignored

Density range.

Optimize range for each image?
Fixed range(s)?
Tells us more about the originals

Reference targets – scale and dimensional, tone and color reproduction.

What types of targets are appropriate for preservation reformatting?
Are visual reference targets required for individual preservation master files?

Quality control – best approach for QC with high-bit images?

Tracking properties/characteristics of originals as metadata vs. better approaches from an imaging perspective –

Potentially imaging approach offers more direct information (visual and/or numeric) information about the source/original

Spatial Resolution Comparison Chart 1

	Format	ClarkVision* Film vs. Digital Equivalents	NARA Guidelines	3,000 ppi	4,000 ppi
Camera Originals and High-Quality Duplicates -positive -negative -transmissive -reflective	35mm and medium format, up to 4”x5”	35mm film = 2 - 16 megapixels 6cm x 4.5cm = 10 - 50 megapixels	4,000 lines 800 - 2800 ppi 11 - 16 megapixels	35mm = 4,251 lines or 12 megapixels 6cm x 6cm = 7,087 lines or 50 megapixels	35mm = 5,669 lines or 21 megapixels 6cm x 6cm = 9,449 lines or 89 megapixels
	4”x5” and up to 8”x10”	4”x5” = 45 - 240 megapixels	6,000 lines 600 - 1,200 ppi 26 – 29 megapixels	4”x5” = 15,000 lines or 180 megapixels 5”x7” = 21,000 lines or 315 megapixels	4”x5” = 20,000 lines or 320 megapixels 5”x7” = 28,000 lines or 560 megapixels

	8”x10” and larger	8”x10” = 180 - 960 megapixels	8,000 lines 800 ppi or less 50 megapixels	8”x10” = 30,000 lines or 720 megapixels 11”x14” = 42,000 lines or 1,386 megapixels	8”x10” = 40,000 lines or 1,280 megapixels 11”x14” = 56,000 lines or 2,464 megapixels

*ClarkVision.com

http://clarkvision.com/imagedetail/film.vs.digital.1.html

http://clarkvision.com/imagedetail/scandetail.html

Spatial Resolution Comparison Chart 2

	Format	NARA Guidelines	400 ppi approx. 7.9 lpm	600 ppi approx. 11.8 lpm	800 ppi approx. 15.7 lpm
Reflection Prints and Copies from Prints -positive -negative -transmissive -reflective	8”x10” and smaller	4,000 lines 400 ppi or higher 12.8 megapixels	4”x5” = 2,000 lines or 3.2 megapixels 5”x7” = 2,800 lines or 5.6 megapixels 8”x10” = 4,000 lines or 12.8 megapixels	4”x5” = 3,000 lines or 7.2 megapixels 5”x7” = 4,200 lines or 12.6 megapixels 8”x10” = 6,000 lines or 29 megapixels	4”x5” = 4,000 lines or 12.8 megapixels 5”x7” = 5,600 lines or 22 megapixels 8”x10” = 8,000 lines or 51 megapixels
	Larger than 8”x10” and up to 11”x14”	6,000 lines 430 – 600 ppi approx. 29 megapixels	8”x10” above 10”x12” = 4,800 lines or 19 megapixels 11”x14” = 5,600 lines or 25 megapixels	8”x10” above 10”x12” = 7,200 lines or 43 megapixels 11”x14” = 8,400 lines or 55 megapixels	8”x10” above 10”x12” = 9,600 lines or 77 megapixels 11”x14” = 11,200 lines or 98 megapixels
	Larger than 11”x14”	8,000 lines 570 ppi or lower	11”x14” above 16”x20” = 8,000 lines or 51 megapixels	11”x14” above 16”x20” = 12,000 lines or 115 megapixels	11”x14” above 16”x20” = 16,000 lines or 205 megapixels

		approx. 50 megapixels	20”x24” = 9,600 lines or 77 megapixels	20”x24” = 14,400 lines or 173 megapixels	20”x24” = 19,200 lines or 307 megapixels

References –

“Understanding Resolution- Part 1” by Ronald Harris, at http://home.att.net/~rwharris/UR1.pdf

“Understanding Resolution- Part 2” by Ronald Harris, at http://home.att.net/~rwharris/UR2.pdf