Wet mounting materials in flat bed scanning of photographic materials

Ian Fulton

ABSTRACT

A description of processes used in evaluating wet mounting in flat bed scanning of negatives and transparencies in terms of image resolution and occupational health and safety. The use of targets, scanners, and fluid media to determine appropriate image resolution for classes of materials that included large and small format glass negatives, film based negatives and transparencies. Finally, determination and development of appropriate methods/ procedures for each class of materials or sizes with respect to image resolution and occupational health and safety considerations.

KEYWORDS

image preservation, oil mounting, wet scanning, digitisation.

INTRODUCTION

For the past 30 years in the Australian War Memorial (AWM), preservation of photographic images was carried out by film to film transfer. Images on relatively unstable photographic emulsion carriers such as glass, nitrate and acetate film were duplicated on to new polyester based negatives. The expected lifetime of these new negatives is at least 500 years, according to ISO18901.

In late 2008, the manager of AWM Multimedia announced that Agfa could no longer supply direct duplicating film in a large format size (10" x 8") to the Memorial, and it was time to end our film to film image preservation program. Even though the Memorial had been digitally capturing and preserving images for many years, it was now time to preserve and use collections in a digital format.

Multimedia manager, Hans Reppin brought together a group of people to develop and complete such a transition. Group members were:

- Bob McKendry, AWM digital photographic interpreter
- Shaun Lakin, AWM photographic curator
- Ian Fulton, AWM photographic conservator
- Hans Reppin, AWM multimedia manager.

We went off to search for the best practice in digital image preservation. Hans and Bob searched for suitable scanners with appropriate resolution, and practitioners that could give expert advice. I found some suitable high resolution targets T-90-N-CG on glass and T-90-2-P-TM on film from Applied Image Inc[1] for determining the resolving power of scanners. I also proposed that we investigate oil mounting as a scanning procedure based on our experience in oil immersion microscopy and wet gate printing or copying of negatives.

ScanScience[2], claims that with their fluid and technology, wet scanning will give:

- increased content recorded from film
- increased colour saturation
- higher sharpness and contrast
- greater brilliance
- smoother grain
- higher dynamic range revealing more detail in shadow area.

This paper describes the processes used in evaluating scanning of photographic materials wet (specifically oil) mounting in flatbed scanning of negatives.

EVALUATION PROCESS

We used three sources of expert information.

David Kay[3] is a Digital Imaging Consultant with extensive experience in oil mounting and scanning. David is also ex-Sun Studios from where in Australia, Kodak/Scitex high end scanners are marketed and supported. He was there to help us determine at what resolution our existing photographic collection needed to be scanned at. David also introduced us to US Photographic Conservator Tim Vitale's 2006 paper *Film Grain, Resolution and Fundamental Film Particles* about the fundamentals of scanning film.

Vitale (2006) provides lists of the resolving power of various camera lenses and of various film types, which assisted us to determine appropriate scanning resolutions for each film or print size and type. This information when used in a system resolving power equation, gave maximum resolution in terms of line pairs per mm for film and lens combinations. Resolving power is expressed in line pairs per mm, or it quantifies how close lines can be to each other and still be seen as separate (ie. resolved).

Les Walkling[4] artist, educator and consultant from Royal Melbourne Institute of Technology, helped us with a theoretical understanding of the scanning process, and how a scanner responds to film density. A scanner has a linear response to light levels, whereas photography and the eye have a logarithmic response to light levels. Les also showed us improvements in scanning technology and image processing through new versions of Adobe Photoshop.

Hans Reppin and I travelled to David Kay's studio to try oil mounting ourselves on a Scitex Supreme Scanner. We took our newly purchased resolution targets (with line pairs of various sizes), glass plates and film negatives of various sizes. The oil mounting medium used is known as *Lumina Optical Fluid*[5] a mixture of alkane hydrocarbons, including CAS 68551-16-6 (isoparaffin) and CAS 64742-48-9 (blend of saturated hydrocarbons). *Lumina* is like lighter fluid, as it evaporates quickly, apparently leaving no residues (checked by FTIR). There being no need for cleaning afterwards, negatives can be returned directly to storage.

Following this trial, we concluded that:

- dust particles became transparent
- many scratches disappeared
- silver mirroring was reduced
- oil mounting of glass negatives is difficult (because of trapped air bubbles)
- the tonal range with oil mounting is greater than with dry scanning.

We were encouraged by oil mounting, but we were aware that occupational health and safety factors need to be carefully investigated and satisfied if we were to adopt this practice. A

literature search of this practice revealed that solvents such as Naphtha and Stoddard Solvent were being used in the United States. These solvents are likely to contain aromatic hydrocarbons and thus usage could introduce unnecessary carcinogenic hazards.

Lumina fluid was chosen because of its safer alkane constituents, but we still had to have a risk assessment of using Lumina as required by current Commonwealth OH&S legislation. We engaged an external Occupational Hygienist to carry out this work, and he recommended risk minimisation through using a fume capture and extraction system with an air speed of 0.5 m/sec. A laboratory fume cupboard has to have an air speed of 0.4 m/sec.

THE OUTCOME

When we received our Kodak Eversmart Supreme II scanners and Oil Mounting Stations, I made up a full size fume hood from cardboard that enclosed two workstations, and connected it to an existing air exhaust system. The measured air speed was around 0.25 m/sec. A second cardboard hood was made to enclose only one station, and the air speed was measured at about 0.50 m/sec. A final design was constructed from Perspex for around $700, and air speed of 0.45 m/sec was measured in it. Testing with a smoke stick showed air was being captured up to a distance of 100 to 150 mm from the opening.

Soon after installation of the fume hood, David Kay was brought in to train scanner operators in oil mounting procedures, and I took an observer role. From my notes and David's PowerPoint presentation, I developed a Standard Operating Procedure (SOP) for oil mounting with the assistance of a scanner operator. This SOP was accepted by the Memorial's OH&S Management Committee. The route followed in this project and the resultant SOP has become a model for risk minimization in the Memorial.

After four months scanning photographic material at the resolution shown in Table 1 we concluded that wet mounting does offer plenty of advantages over dry mounting, mainly with respect to minimisation of dust and scratches. This greatly reduces image correction time and the risk of mistaking detail for scratches. However, even though we used *Lumina fluid* and better scanning technology (Scitex Supreme II versus Epson 750/700 Scanner), we were unable to obtain greater detail with wet than with dry scanning. In other words, we were unable to replicate a most important claim of ScanScience.

Format	Scanner Resolution @ 1:1 magnification
35mm and 120 type camera originals	5000 dpi
Large format sheet film	4000 dpi
Non camera original film (dupe/copy)	3150 dpi
Reflective photographs	600 dpi

(No file to exceed 1.8Gb in size)

Table 1: preservation scanning standards

Relative to dry mounting, we found that for oil mounting:

- there seemed to be slight increase in image content
- there was some increase in colour saturation, and brilliance
- there seemed to be slight increase in contrast across tonal boundaries
- the grain was much smoother
- there was a higher dynamic tonal range in shadow areas
- and finally, oil mounting gave a better result.

ENDNOTES

1 Applied Image Inc., manufacturer of precision, high quality, test targets <http://www.aig-imaging.com/lmatest.html>

2 ScanScience website http://www.scanscience.com/ <http://www.wetmounting.com/index.html>

3 Kay, David Digital imaging consultant <http://www.capturescanprint.com/>

4 Les Walkling, Senior Lecturer RMIT <http://www.leswalkling.com> <http://rmit.com.au/browse?STYPE=PEOPLE&QRY=e50906>

5 Lumina Optical Fluid (found on ScanScience site), <http://www.wetmounting.com/Pages/Lumina.html>

REFERENCES

ISO 18901:2010. Imaging materials, Processed silver-gelatin-type black-and-white films -- Specifications for stability

Vitale, T. 2006, *Film Grain, Resolution and Fundamental Film Particles*, Version 9, March 2006 © 2006, use by permission only, found at <http://cool.conservation-us.org/coolaic/sg/emg/library/pdf/vitale/2006-03-vitale-filmgrain_resolution.pdf>

BIOGRAPHY

Ian Fulton was a medical scientist prior to training in conservation 1978-1980.

From 1981-1985, was the first paper conservator for the Regional Galleries Association of Victoria. In 1986 was paper conservator at the Australian War Memorial(AWM). From 1987-1991 received training in interiors architecture, before returning to the AWM as a photographic conservator in 1992.

CONTACT DETAILS

Ian Fulton
Senior Conservator – Photographs, Film & Sound
Australian War Memorial
Canberra ACT

Email: ian.fulton@awm.gov.au