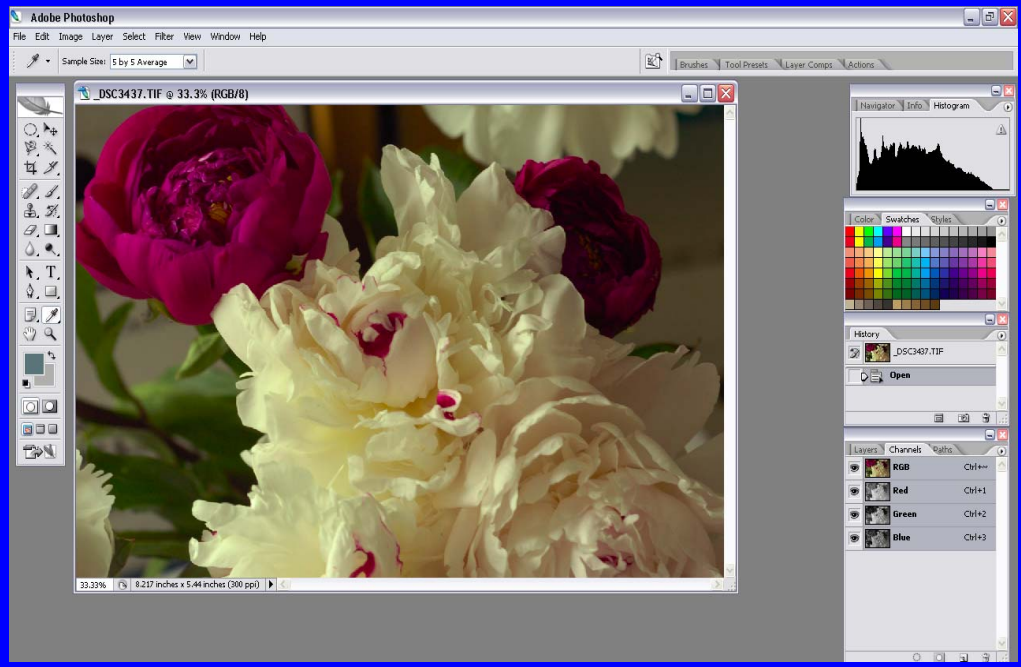
Born Digital Photographs: Acquisition and Preservation Strategies

AABC Conference 2006



Rosaleen Hill AABC Conservation Coordinator

E-mail: rhill@aabc.bc.ca

Policy and PROCEDURE

Policy is easy

Procedure is hard

Policy and PROCEDURE

Library of Congress

Sustainability of Digital Formats
Planning for LC Collections Still Image Preferences

www.digitalpreservation.gov/formats/content/still_preferences.shtml

Acquisition and Preservation Strategies

1. Preservation policy for e-records

   ⇒ accept only certain file formats and certain storage formats?

   ⇒ triage “at risk” media on appraisal? (migrate to accepted file format or storage device before arrangement and description)

   ⇒ policy and procedures

Camera Choice – What Matters

1. Mega pixel (MP)
2. Sensor size
3. File formats

Focus shifts between acquired ‘born digital’ and an institution which creates ‘born digital’ records

Mega Pixel

MP		300 dpi
2	1600 x 1200	4 x 6
3		5 x 7
6		8 x 10
14		11 x 14
23		13 x 20

Sensor Arrays - CCD

- Charged-coupled device

- Capture light on the small photosites
- Charges on the first row are transferred to a **read out register**. Signals are then fed to an amplifier and then on to an analog-to-digital converter. The charges on each row are "coupled" to those on the row above so when one moves down, the next moves down to fill its old space. In this way, each row can be read—one row at a time.

CMOS Sensor

- **Complementary Metal Oxide Semiconductor** (CMOS refers to how a sensor is manufactured, and not to a specific sensor technology)
- Faster, individual processing of pixels, less expensive to produce

Sensor Size

- 1/8 size = 5.5 x 4.1 mm
- 2/3 size = 23.7 x 15.5 mm

As sensor size decreases
photosites get smaller
resulting in less light capture

- Poor signal/noise ratio
- Image more grainy,
artifacts

www.dpreview.com

Digital Cameras Side-by-Side, 2 cameras

	Nikon D200	Canon EOS 5D
Image		
Format	SLR	SLR
Price (street)	US$1656	US$3089
Also known as		
Camera body		
Release Status	Unreleased	
Max resolution	3872 x 2592	4368 x 2912
Low resolution	2896 x 1944, 1936 x 1296	3168 x 2112, 2496 x 1664
Image ratio w:h	3:2	3:2
Effective pixels	10.0 million	12.7 million
Sensor photo detectors	10.9 million	13.3 million
Sensor size	23.6 x 15.8 mm	36 x 24 mm
Sensor type	CCD	CMOS
Colour filter array	RGB	RGB
Sensor manufacturer	Sony	Canon
ISO rating	100 - 1600 in 1, 1/2 or 1/3 EV steps (up to 3200 as boost)	100 - 1600 in 1/3 stops, plus 50, 3200 as option
Zoom wide (W)	n/a	n/a

Noise

- Relates to rate of light capture
- Higher ISO = shorter amount of time to capture light = higher signal/noise ratio

  noise = unwanted ‘artifacts’ in image area
- So image capture at low ISO is better

File Formats

- JPEG
- TIFF
- JPEG 2000
- RAW
- DNG

Compression

- Lossy Compression
- Lossless Compression

- Lossless/Non-compressed - preferred

Compression

Data (pixels) that are duplicated are deleted or saved in a shorter form ie. Blue skies

aaaaaabbbbccccc or 6a4b5c

Pro = smaller file

Con = data loss

Lossy Compression

- When a ‘lossy compressed image is decompressed, it is different from the original image because some of the information was eliminated as part of the compression format’.

Besser, Howard. 2000 *Digital Longevity*. Handbook for Digital Projects: A Management Tool for Preservation and Access. NEDCC. Pg.158
www.nedcc.org

Lossless Compression

- When a lossless compressed image is decompressed, it is identical to the image before it was decompressed.

  (TIFF - LZW lossless compression)

Besser, Howard. 2000 *Digital Longevity*. Handbook for Digital Projects: A Management Tool for Preservation and Access. NEDCC. Pg.158 www.nedcc.org

JPEG

- Joint Photographic Experts Group
- **NOT AN ACCEPTED PRESERVATION FORMAT**
- Algorithm – lossy and compressed
- Converts image data from 12 or 14 bit format to 8 bit format

- JPEG starts compression at 8 bit level
- 20: 1 10:1 4:1 compression ratios

www.shortcourses.com/choosing/files/08.htm

Smallest compression ratio

Highest compression ratio

JPEG

- Each opening and resaving of a JPEG results in cumulative losses
- Image changes and quality decreases each time a JPEG is saved

TIFF

- Tagged Image File Format
- Currently accepted **PRESERVATION** format
- TIFF = file wrapper = holds data in original order and format

TIFF

- Lossless and **choose non-compressed**
- TIFF – lossless LZW compression option – ⇓ files size 3 – 30%
- Retains RGB values for each pixel
- High bit depth
- Metadata can be attached
- ICC profiles can be attached

TIFF and software

- TIFF is open but –
- Some cameras and imaging s/w create TIFF type files that can’t be opened by other software – add proprietary s/w
- Adobe PhotoDeluxe Home Edition 4.0

JPEG 2000

- JPEG 2000 very different from current JPEG
- Uses wavelet compression to give a higher compression (20% better) and better image quality with fewer artifacts (image flaws).
- Wavelet technology also allows an image to be "streamed." A low resolution image appears quickly and then is gradually "filled in" with more detail.

  Ideal for web use but not preservation
- From shortcourses.com

Raw Files

- RAW stores image data from sensor without processing in camera
- RAW records all camera settings
- RAW becomes the ‘negative’ or ‘original’
- Files approximately 60% smaller than uncompressed TIFF files
- Image processing ‘developing’ done in computer with software

Fraser, Bruce. 2005. Camera Raw with Adobe Photoshop CS2. Peachpit Press, Berkeley, California.

.DNG Adobe digital negative

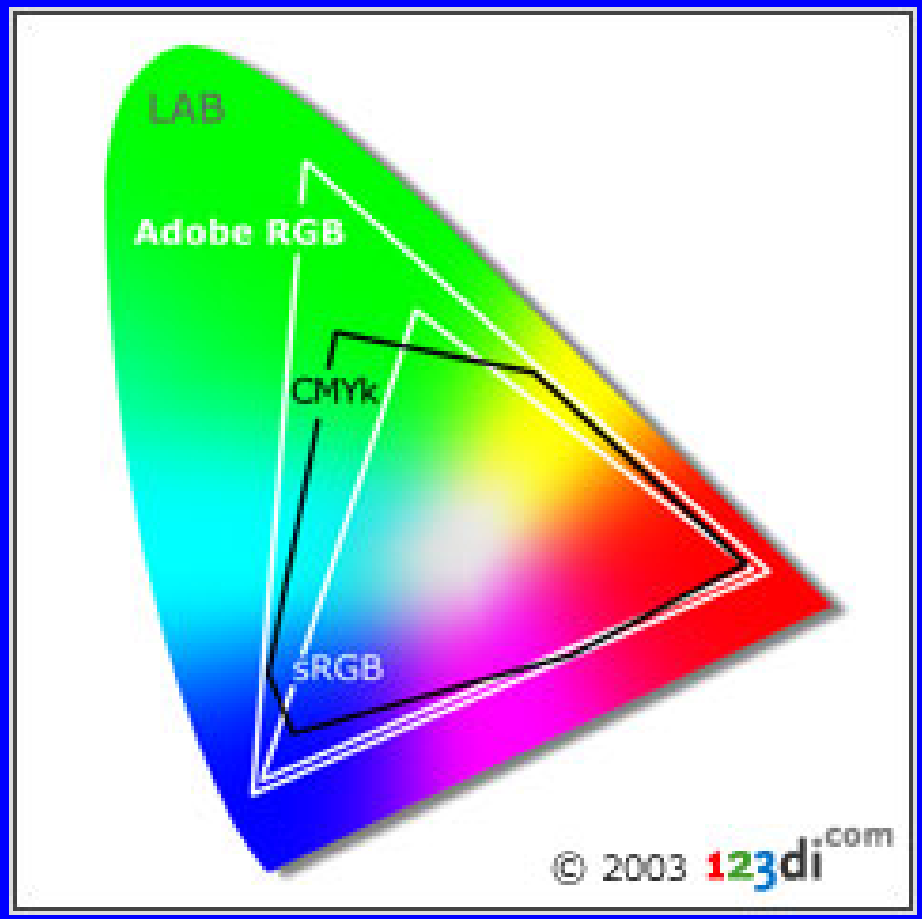
- DNG metadata publicly documented
  - –broader platform
  - – if used will allow access to file formats no longer supported by camera manufacturer
- Extension of TIFF 6.0 – compatible with TIFF-EP

DNG

- Extensis, Canto, Apple, and iView support DNG
- Photoshop CS2

- www.adobe.com/products/dng/main.html

SRGB and Adobe RGB (98)



Documentation Calibration Target

- Allows for white point correction
- GretagMacBeth colour checker – neutral grey scale – known values
- Colour squares useful for adjusting reds, oranges and yellows

GretagMacBeth Color Checker

- Mini

  3 x 4”
- Full

  8.5 x 11”

HELP!

Out of Gamut: Calibrating Camera RAW in Photoshop CS
Fraser, Bruce. 2004.
www.creativepro.com/printerfriendly/story/21351.html

http://fors.net/chromoholics/

Metadata

Data about data

Technical

- Relating to the file format e.g. TIFF
- Relating to camera settings

Descriptive

- Terms to describe the image

Metadata

NISO 39.87

Technical Metadata for Digital Still Images

- in review process - ballot July 18- August 26, 2005 - still in development

www.niso.org

Descriptive Metadata

RAD Compliant

Digital Asset Management (DAMs)

- Windows
- ACDSee
- iView
- iPhoto – Mac
- Portfolio
- Photoshop CS2 – File Browser
- Aperture

File Storage

- Optical media
- Hard drives
- Server

File Storage

- CD Rs – Gold – preservation standard
- Mitsui - Mam-e
- www.mitsuicdr.com/products/gold/archive.html
- Burn at a slow speed 4 – 8X
- LE – 5 – 20 years?

Iraci, Joe. "The Relative Stabilities of Optical Disc Formats" Restaurator Vol. 26, No. 2 (2005).

http://aic.stanford.edu/sg/emg/library/pdf/iraci/relativeStabilitiesOpticalDiscs.pdf

Gold Cd – Preservation Standard

1. Gold CD Only choice

   Phthalocyanine, a light-green compound that is very stable in the presence of heat and light

Dye Type		Color appearance (Viewing the laser reading side of the disc)	
	Actual Color	On Gold Metal	On Silver Metal
Phthalocyanine (thalo-sy-a-neen)	clear or very light green	gold or greenish gold	silver
Cyanine (sy-a-neen)	blue	green	blue
Azo (ay-zo)	dark blue or deep blue	dark green	dark blue or deep blue

Table 2: Dye type and color appearance—CD-R discs (recordable discs)

Byers, Fred. 2003. **Care and Handling of CDs and DVDs. CLIR: Washington DC. pg**.8.

Storage

- CD-R ~670 MB
- Actual 650 MB
- TIFF file i.e. 10 - 20 MB per image
- 30 – 60 images per CD

- Nikon D2H 4MP = ~12MB

Labeling Gold CDs

- Mark clear inner hub
- Use only solvent-free, water-based, fine-tip markers, such as the Dixon Redisharp Plus.
- Do not use adhesive labels

Gold CD Suppliers

Prescision Sound
3117 Norland Avenue
Burnaby, BCV5B 3A9
Phone: (604) 299-4141Fax: (604) 299-4146

Skana Imaging Solutions Inc.
Vancouver BC
Tel (604) 540-9121
www.skanaimaging.com/contact.php

DVDs

- No preservation standard
- Not recommended for permanent or semi-permanent storage

Hard Drives

- 80 – 100 GB external HDD storage
  ~ $180-190 for 100 GB (London Drugs)

Digital Output

- Printer ink
- Printer paper
- www.wilhelm-imaging.com
- www.inkjetart.com
- www.imagepermanenceinstitute.org
- Espon/Canon/HP etc.

www.wilhelm-imaging.com

Wilhelm Imaging Research

Google Search
WWW www.wilhelm-research.com

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The Highest Standard of Care: Sub-Zero Cold Storage For Small Personal Collections to Large Institutional Archives

"High-Security, Sub-Zero Cold Storage for the PERMANENT Preservation of the Corbis-Bettmann Archive Photography Collection"

By Henry Wilhelm with Ann C. Hartman, Kenneth Johnston, Els Rijper, and Thomas Benjamin

View 6-Page Article From IS&T Archiving Conference April 2004
Posted May 17, 2004

WIR Technical Articles About Image Permanence Test Methods and the Permanence of Digitally-Printed Photographs

JUST PUBLISHED!

Article from "Japan Hardcopy 2005" Conference in Tokyo June 8-10, 2005

"New Test Methods for Evaluating the Humidity-Fastness of Inkjet Prints"

By Mark McCormick-Goodhart and Henry Wilhelm

View 5-page Article

General Interest Articles About Image Permanence and Preservation from Newspapers, Magazines, Books, and Websites

NEW WIR Press Release

Canon U.S.A., Inc. Endorses the Independent WIR Certified Image Permanence Testing Program and Seal, Joining Epson, Hewlett-Packard, and Lexmark in Providing Consumers with Standardized Print Longevity Ratings

Go To Press Release
Posted April 8, 2005

WIR Print Permanence Ratings for Desktop Printers, 4x6-inch Dedicated Photo Printers, and Silver-Halide Digital Minilabs

NEW UPDATE!

Display Permanence Ratings for Current Products in the 4x6-inch Printer Category

Includes WIR Data for the NEWEST 4x6-inch Printers from Dell, Lexmark, Canon, Hewlett-Packard, and Epson

Also Includes WIR Display Permanence Ratings for the Latest Digital Minilab Silver-Halide Color Papers:

WIR/DPR Ratings (Years)
(40) Fujicolor Crystal Archive
(22) Agfacolor Sensatis
(19) Kodak Edge Generations
(17) Konica Minolta Impresa

WIR Print Permanence Ratings for Medium-Format Tabletop Inkjet Printers and for Large-Format Inkjet Printers

Print Permanence Ratings for Epson Stylus Pro 9800 Printer and UltraChrome K3 Inks

Epson Stylus Pro 9800 Full-Screen Page View
Updated July 1, 2005

Epson Stylus Pro 9800 Download 8-Page PDF

Print Permanence Ratings for Epson Stylus Pro 4800 Printer and UltraChrome K3 Inks

WIR

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Posted July 31, 2003

View Article
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October 2001

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"All the major aspects of output affect the enjoyment of digital photography. It's important to consider printer speed as well as longevity and color gamut."

View Article
Download 6-Page PDF
Posted May 28, 2005

Guidebook from Canadian Council of Archives

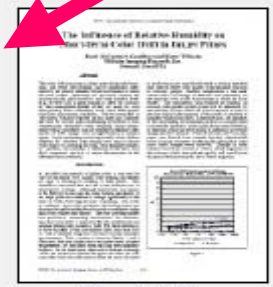
"Cold Storage of Photographs at the City of Vancouver Archives"

By Sue Bigelow, Conservator

View 36-Page Guidebook
Download 36-Page PDF for Guidebook
Posted May 17, 2004

"The Influence of Relative Humidity on Short-Term Color Drift in Inkjet Prints"

By Mark McCormick-Goodhart and Henry Wilhelm



View Article
Download PDF
October 2001

Article From From PHOTO Techniques Magazine
Jan/Feb 2005

"An Interview with Henry Wilhelm of Wilhelm Imaging Research"

"The noted image-permanence researcher details the history of the field and considers the future of photography."

By Paul Schranz

"The Permanence and Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides, and Motion Pictures"

By
Henry Wilhelm
with
contributing author
Carol Brower

Originally Published in 1993

High-Resolution Adobe Acrobat PDF files for the entire 758-page book or for any or all of the 20 individual chapters may be downloaded for FREE!

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"Humidity-Induced Color Changes and Ink Migration Effects in Inklet Photographs in Real-World Environmental Conditions"

By Mark McCormick-Goodhart and Henry Wilhelm

Ink Jet Printers

Printers vary widely

- Type of inks they use
- Type of paper that is recommended
- Can have a profound effect on the stability of the printed image.

Ink Types

1. Dye based inks
2. Pigment based inks

- Pigment based inks

  are considered the better choice – light fastness and stability
- Dyes – brighter colours – more saturation on glossy papers

No-Name Inks

"Cheap Ink Probed" September 2003
PC World Magazine –
News & Trends section.

www.wilhelm-research.com/pdf/PCWorld_Cheap_Inks_2003_10.pdf

Ink Jet Papers

- Images can be printed on coated or uncoated papers

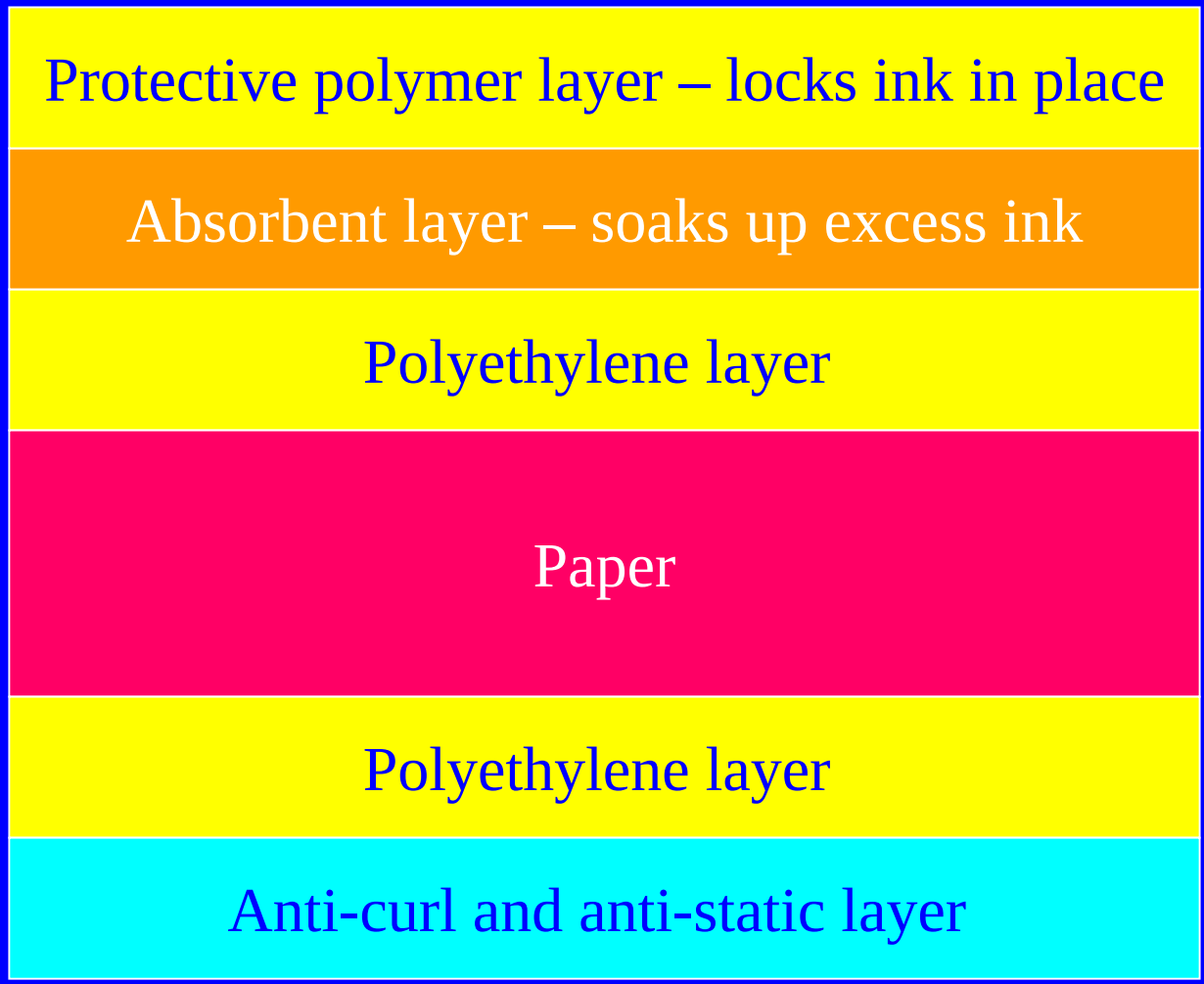
Coated Papers

- Two common types
- ‘swellable’ paper
- ‘porous’ paper

Swellable Paper

- Swells with moisture from water based inks – allows the ink to penetrate the top layers of the paper

Swellable Paper



Swellable Paper

- Generally higher gloss than porous paper
- Longer ink drying times
- Paper feels smooth
- “Rub test” drop of water on paper will cause swellable paper to “melt” the surface – a slippery film is formed

Porous Papers

- Surface coated with small, inert ceramic particles – create tiny cavities in which the ink is deposited
- Particles prevent ink spread – porous paper tends to be more resistant to RH changes – paper can be handled immediately after printing – preferred when pigmented inks used.

Porous Papers

- Generally more matte in appearance
- Shorter ink drying time
- Can feel sticky compared to smooth swellable papers

What Effects Stability?

- RH and Temperature
- Pigment-based ink jet prints less sensitive than traditional colour prints because they use pigments rather than dyes
- At high RH images made with dye inks on swellable paper can blur due to ink movement

Light

- Light stability studies vary
- Pigment based inks generally recommended

www.wilhelm-research.com

Table 1. "Standard" Home Display Illumination Levels Used by Printer, Ink, and Photo Paper Manufacturers

120 lux/12 hrs/day	450 lux or 500 lux/10 hrs/day or 12 hrs/day
Kodak	Fuji Hewlett-Packard Epson Canon Lexmark Ilford Konica Minolta Agfa-Gevaert DuPont Ferrania InteliCoat Somerset Arches LexJet Lyson Luminos Hahnemühle Premier Imaging Products American Inkjet MediaStreet

or color balance failure point after the equivalent of 100 years of display are given a rating of "more than 100 years" until such time as meaningful dark stability data are available (see discussion in No. 6 below).

Eastman Kodak bases its home display-life calculations on 120 lux/12 hours per day, rather than 450 lux/12 hours per day. Some of Kodak's display-life predictions for Kodak Ultima Picture Paper are *almost 15X* longer than the predic-

Gaseous Pollutants

- Little or no effect on traditional colour prints
- Ozone can effect dye images on porous paper
- More research needs to be done

Porous Papers

- No polymer protective layer
  - Ozone, SO_2, No_x

Water

- Dye based ink jet prints – can blur, stick together, handling when wet can cause much surface damage
- Pigment based inks generally water resistant – even on plain printer paper

Longevity – Paper Choice Matters

Printer	Paper	Display Years
Epson 2200	Espon W/C	90
	Hammermill Jet Print	~30
Epson 820,825..	Epson Colorlite Semigloss	27
	CompUSA High Gloss	5
Traditional Photo Processing	Fujicolor Crystal Archive	60
	Kodak Ektacolor Edge 8	22

March 2003

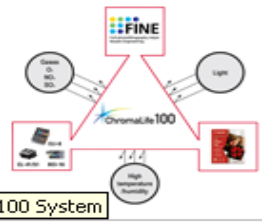
What are the key differences among the Epson Ink Solutions?

Key Differences	4-Color Dye Inks	Photo Inks™	DURABrite® Inks	UltraChrome™ Inks	UltraChrome Hi-Gloss Inks	Archival Inks
Target Application	General purpose printing and home photo 	Advanced amateur photographers and home photo 	Home general purpose and photo—dedicated productivity with the flexibility to print photos 	Commercial, fine art, and advanced amateur photography; pre-press proofing, posters, and signage 	Photography, including commercial, fine art, and advanced amateur 	Indoor/outdoor signage, fine art reproduction, fine art photography, and Print for Pay 
Current Supported Epson Printers	Epson Stylus C44UX, Epson Stylus Color 1520	Epson Stylus Photo R300 / R300M / 1280 / RX500	Epson Stylus C64 / C84 / CX5400 / CX6400	Epson Stylus Photo 2200, Epson Stylus Pro 4000/7600/ 9600/10600	Epson Stylus Photo R800	Epson Stylus Pro 10600
Ink Characteristics	• 4-color dye-based ink—Cyan, Magenta, Yellow, and Black (CMYK) • Quick-Drying formula results in vibrant output without bleeding or smudging • Wide color gamut as well as the largest	• 6-color dye-based ink—CMYK plus light cyan and light magenta inks (CMYKcm) which smooth the tonal gradations critical for photography • Quick-Drying formula has	• 4-color pigment-based ink (CMYK) delivers exceptional text and image quality on plain and matte papers; also produces good output on glossy papers (optimized for the Epson	• 7-channel print head and 8 cartridges: Pigment-based CMYKcm (including Photo Black and Matte Black)plus Light Black to improve the neutral appearance for B&W prints • Color gamut	• 8-channel print head and 8 cartridges: Uses Hi-Fi ink set of Cyan, Magenta, Yellow, Matte Black, Photo Black, Red, Blue, and Gloss Optimizer • First pigment-based ink set to deliver archival	• 6-color pigment-based ink—CMYKcm • This pigment-based ink has a good color gamut and a wide range of media flexibility, with incredible lightfast ratings ideal for archival applications and

Canon Chromalife Inks

ChromaLife 100 System

ChromaLife 100 inks and paper are designed to withstand common, real world conditions that can cause a photo to fade.



ChromaLife 100 System

100 Years in an Album*

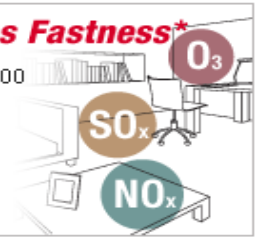
Genuine Canon inks and paper that provide up to100 years album life.

30 Years Lightfastness*

New Canon dye inks and Canon photo papers that resist fading for 30 years.

10 Years Gas Fastness*

The ChromaLife 100 system has been tested to resist fading from mixed gases.



Improved resistance to heat and humidity

ChromaLife 100 inks and Canon Photo Paper are designed to resist real world conditions that cause photos to fade.

Improved Contrast

Introduction and Purpose

As an aid to consumers, Canon Inc. has pre-performed simulated, accelerated image permanence testing to predict estimated longevity of photos printed with the Canon

Digital Preservation Policy

Erpa Guidance Digital Preservation Policy Tool

www.erpanet.org/guidance/docs/ERPANETPolicyTool.pdf

A Framework of Guidance for Building Good Digital Collections (2nd Edition – 2004)

www.niso.org/framework/Framework2.html

The NINCH Guide to Good Practice in the Digital Representation and Management of Cultural Heritage Materials

www.nyu.edu/its/humanities/ninchguide/

Cornell University Digital Preservation Policy

http://commondepository.library.cornell.edu/cul-dp-framework.pdf

Digital Preservation Policy

Digital Preservation for Museums

www.chin.gc.ca/English/Digital_Content/Preservation_Recommendations/index.html

Calimera Guidelines

www.calimera.org/Lists/Guidelines/Digital_preservation.htm

PADI – National Library of Australia

www.nla.gov.au/padi/index.html

E – Project AABC List Serve

Using the AABC list serve as a discussion forum we could jointly create a digital preservation policy for still images for small to medium sized archives

Good idea?

Bad idea?