

The Intimate Relationships of Inks and Papers: You Can't Talk About the Permanence of One Without Considering the Other

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One of the most wonderful things about inkjet printing is that for the first time in the history of photography, the image forming process and the paper it is printed on are functionally separated. Photographers are now able to make prints on virtually any absorbent material that can be fed through their printers! There are a huge number of papers, high-gloss plastic-based materials, canvas, and other types of print media available. Photographers getting involved with inkjet printing very quickly come to understand that the paper they select plays a critical role in determining the quality of the printed image. For any given inkset – be it dye-based or pigment-based – the media can have a profound influence on color saturation, density range, smoothness and uniformity of tone, brightness, surface texture, ink drying properties, and the subjective “feel” of a print. But what is not at all obvious is the influence the media will have on the eventual life of prints when stored in the dark or when exposed to light on display. In terms of image permanence – refer to the data on the following three pages – the choice of media can be every bit as critical as it is with image quality. With a given inkset, the difference in light fading rates between the longest-lasting paper and the least stable paper can exceed 20 to 1. That is, the amount of fading that will take place in 20 years with the best paper can occur in only one year – or even less – with the worst! Available ink and media combinations also exhibit major differences in terms of both humidity-fastness and water resistance.

In the short history of high-quality pictorial inkjet printing – which on the desktop can be dated to the 1994 introduction of the first Epson Stylus Color 720 dpi printer – making long-lasting prints was not a top priority. In fact, it really was not considered at all. And all the manufacturers were in the same boat: it did not matter if the printers were made by Epson, Hewlett-Packard, Canon, or Lexmark. All of the photo quality inkjet printers now on the market evolved from office text printers. Readable black text and colorful graphs and pie charts were the goal. Most of the inksets currently available from the major printer manufacturers are really carryovers from the office. Many have never left the office. Photographic image quality on the desktop improved very rapidly and the machines were soon adopted by photographers for printing serious work. Those photographers began selling that work for serious money to customers who, in many cases, expected the prints to last at least as long as traditional color photographs. Rather suddenly, Epson, Hewlett-Packard, Canon, and Lexmark found themselves in a whole new field – professional photography – a field that these manufacturers are only now beginning to really understand. Epson was the first to move and in late 1999 the company announced that improved dye-based inksets with matched media and highly stable pigmented inksets would be introduced in the United States during the year 2000. The first of these improved Epson products to reach the market are the inks and photo media supplied for the new Epson Stylus Photo 870 and 1270 printers.

The evolution of the Iris printer followed a path similar to that of the desktop field – Iris machines were designed for direct digital proofing, technical applications, and making comps. Throw-away things, not photographs or works of art. The initial inksets provided by Iris were never intended for making prints to be matted, framed, and displayed in the same way traditional color photographs and other fine art prints are used. This gap in the market led to the development of “archival” inksets with improved stability – the Lyson Fine Arts inkset introduced in 1994 for the Iris printer was the first. As applied to inkjet inks and papers, the word “archival” has no specific meaning in terms of how long a print might last before noticeable fading occurs when displayed, or when the print is stored in the dark (where, especially under commonly-encountered high-humidity conditions, ink bleed, color balance shifts, and yellowing can occur). Rather, the term “archival” has come to mean that when designing a product, the manufacturer intended that it will last at least for a “reasonable” length of time. But, with only a few exceptions, the independent companies producing “archival” inks are not the same companies that are designing and producing the papers used with their inks. This is a real complication – a little cooperation between these firms at the R&D stage could go a long way toward producing products with the elusive combination of better image quality, better printability, and better image permanence.

The use of six inks in a photo printer can provide significantly enhanced smoothness of delicate tones and freedom from visible dots in the highlights and near-highlights together with enhanced color saturation and brilliance. The 6-ink systems employ diluted, low-density magenta and cyan inks along with the usual full-concentration cyan, magenta, yellow, and black inks and allow a substantially greater number of dots to be laid down in medium- and low-density portions of an image than do four-ink printers. However, particularly with certain types of media, the 6-ink systems provide less image stability – typically two to three times less – than do 4-ink printers using the same basic ink formulations. Initially this was not well understood and it presents a difficult challenge for ink and media manufacturers alike. A good benchmark for evaluating the stability of an ink/paper combination is Fujicolor Crystal Archive paper. With a Wilhelm Imaging Research rating of 60 years of display in a fairly bright environment before noticeable fading or color shift occurs, this is by far the most stable traditional silver halide color paper available. Crystal Archive paper is serious, long-lasting photography. Inkjet printing must aspire to be at least as good.

Inks and Media for Desktop Inkjet Printers: Years of Print Display Before Noticeable Fading Occurs

For Members of the International Association of Fine Art Digital Printmakers
Distributed at the March 6, 1999 IAFADP Meeting in New York – Updated January 30, 2000

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Desktop Inkjet Printers (older products)

Hewlett-Packard, Canon, and Lexmark Printers

HP PhotoSmart w/HP PhotoSmart Glossy Paper	6–8 years
HP 2000C w/HP Deluxe Photo Paper (HP/EK)	2–3 years**
HP 722C w/HP Deluxe Photo Paper (HP/EK)	1 year**
Lexmark 5700 w/Photo Inks & Photo Paper	1 year
Canon BJC-7000 w/Photo Inks & Photo Paper	<1 year
Canon BJC-6000 w/Photo Inks & Photo Paper	<1 year

Epson Photo 700 and Photo EX Printers (std. Epson inks)

Epson Photo Paper (1998 "Improved" type)	2 years
Mitsubishi Artist Mirror Gloss Heavy Paper	2 years
Polaroid Premium Quality Photographic Paper	3 years**
Epson Photo Quality Glossy Film	1.5 years**
Imation Photographic Quality Paper	1.5 years**

Epson Photo Paper (1997 type) – Glass filter	1.2 years
Epson Photo Paper (1997 type) – UV filter	1.2 years
Epson Photo Paper (1997 type) – bare-bulb	0.9 years
Kodak Inkjet Photo Quality Paper (1997 type)	0.7 years**
Konica Photo Quality Inkjet Paper QP	0.6 years**

Epson Stylus 3000 17x22-inch Printer (standard Epson inks)

Epson Photo Quality Glossy White Film	2–3 years
Epson Photo Quality Glossy Paper	2 years
Epson Photo Quality Ink Jet Paper [matte]	1–2 years
Kodak Inkjet Photographic Quality Paper [1997]	1 year

Epson Stylus 3000 Printer (4-ink Lysonic E inks)

Luminos Lumijet Premium DW Glossy (discon.)	>120 years
Luminos Lumijet Premium Tapestry X (tentative)	>120 years
Arches Cold Press Paper	50–55 years
Bulldog Photo Rag Paper	28–30 years
Somerset Velvet Paper	>25 years
UltraStable Canvas (glossy)	>15 years
Lysonic Standard Fine Art Paper	4–6 years
Epson Photo Paper	4–5 years

Desktop Inkjet Printers (newer products)

Epson Stylus Photo 870 and 1270 Printers (Epson inks)

Epson Matte Paper – Heavyweight	24–26 years
Epson RC Premium Glossy Photo Paper (new)	9–10 years
Epson Photo Paper	6–7 years

Hewlett-Packard PhotoSmart P1000 and P1100 Printers

HP Premium Plus Photo Paper, Glossy	4–5 years**
HP Premium Photo Paper, Glossy	2–3 years**

Hewlett-Packard DeskJet 970C and 1220C Printers

HP Premium Plus Photo Paper, Glossy	4–5 years**
HP Premium Photo Paper, Glossy	2–3 years**

Lexmark Z51 Color Jetprinter (Lexmark 12A1990 Photo inks)

Lexmark Photo Paper (1999 "new" type) (tests in progress)	
Kodak Inkjet Photo Paper (1999 type) (tests in progress)	

Epson Stylus Pro 5000 Printer (6-ink Lysonic E inks)

Lysonic Standard Fine Art Paper	<1.0 year
Epson Photo Paper	2.0 years

**** Products Having Poor Humidity Fastness:** These products are not recommended for long-term home use or professional applications. Over time, the prints may suffer serious image deterioration when stored in the dark or displayed in commonly encountered conditions of high relative humidity. These problems may include one or more of the following:

- Ink Bleeding (gradual lateral ink diffusion)
- Density Changes (increases or decreases)
- Color Balance Changes
- "Bronzing" in High Density Areas
- Sticking and Ink Transfer

Note: Tests are currently in progress with MediaStreet Generations pigmented inks and Generations Royal Plush paper in 6-ink Epson photo printers and 4-ink Epson 3000 printers; with MIS Archival Inks and Weber-Valentine Guardian GWCS250 paper in 4-ink Epson 3000 printers; and with new Canon 6-ink photo printers. Go to: www.wilhelm-research.com

The display-life predictions given here were derived from accelerated glass-filtered fluorescent light fading tests conducted at 75°F and 60% RH and are based on the "standard" indoor display condition of 450 lux for 12 hours per day employed by Wilhelm Imaging Research, Inc. Illumination conditions in homes, offices, and galleries do vary, however, and color images will last longer when displayed under lower light levels; likewise, the life of prints will be shortened when displayed under illumination that is more intense than 450 lux. The predictions given here are the years of display required for specified, easily noticeable fading, changes in color balance, and/or staining to occur. These display-life predictions apply only to the specific ink and paper combinations listed. ©2000 by Wilhelm Imaging Research, Inc. All rights reserved. Wilhelm Imaging Research, Inc., Box 775, Grinnell, Iowa 50112 U.S.A. • www.wilhelm-research.com • e-mail inquiries: wilhelmweb@aol.com

Wide-Format Inkjet and Digital Photo Paper Prints: Years of Print Display Before Noticeable Fading Occurs

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HP Pigmented UV Inks for HP DesignJet 2500/3500CP Printers

Arches Hot Press Paper	(tests continuing)	>200 years
Legion Waterford DI Paper	(tests continuing)	>200 years
HP Studio Canvas	(tests continuing)	>120 years
Dr. Graphix Pure White Canvas		>100 years
Hahnemühle Albrecht Dürer Paper ⁽¹⁾	(tests continuing)	>90 years
Hahnemühle William Turner Paper ⁽¹⁾	(tests in progress)	
Somerset Velvet Enhanced Paper	(tests in progress)	

HP Dye-Based Inks for HP DesignJet 2500/3500CP Printers

HP Studio Canvas		14–16 years
Arches Hot Press Paper		6–7 years
Legion Waterford DI Paper		6–7 years
HP High-Gloss Photo Paper		6 years
HP Heavyweight Coated Paper		5 years

Roland Pigmented Inks for Roland Hi-Fi Jet Printers

Legion Concorde Rag Paper		120–130 years
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ColorSpan EnduraChrome Inks for Giclée PrintMaker FA

Arches Cold Press Paper		75–80 years
ColorSpan Fine Art Detail Canvas		18–20 years
UltraStable Canvas (glossy)		16–18 years
ColorSpan Photobase Paper		8–10 years

AIJ UV Gold Inks for ENCAD NOVAJET Printers

American Ink Jet UV Gold Glossy Paper		30–35 years
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Ilford Archiva Dye-Based Inks for ENCAD Printers

Ilford Ilfojet Photo Glossy Paper (ONLY!)		70–80 years
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ENCAD GA and GS Dye-Based Inks for ENCAD Printers

ENCAD QIS Photo Glossy Paper & QIS Canvas		1–2 years
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ENCAD GO Pigmented Inks for ENCAD Printers

ENCAD QIS Photo Glossy Paper		>100 years
ENCAD QIS Canvas		>100 years

AIJ Pinnacle Gold Epson Inks for Epson 9000 Printers

Arches Cold Press Paper	(tests continuing)	>15 years
AIJ Prototype Artists Paper	(tests continuing)	>15 years
Somerset Velvet Paper		6–8 years

Cerographic Giclée Prints⁽²⁾

(Pigment-Wax Hot-Melt Inkjet Process)

Somerset Velvet Paper		26–28 years
UltraStable Canvas (glossy)		18–20 years

Ataraxia Studio Collectors Color Prints⁽³⁾

(Pigment-Gelatin Digital Print Process)

White Polyester-Base Prints	(tests continuing)	>200 years
RC-Base Photographic Paper		>100 years

Fuji Pictography 3000/4000 Digital Color Printers

(Silver Halide/Dye-Transfer IR Laser Exposure Process)

RC-Base Pictography Paper	(tests in preparation)	
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Current Photographic Color Negative Prints

Fujicolor Crystal Archive Paper		60 years*
Kodak Ektacolor Edge 7 and Royal VII Papers		18 years
Kodak DuraLife Paper	(tentative)	18 years
Kodak Ektacolor Portra III Professional Paper		14 years
Konica Color QA Paper Type A7		14 years*
Agfacolor Paper Type 11		13 years

* Predictions integrated with manufacturer's Arrhenius dark storage data

Ilford Ilfochrome Silver Dye-Bleach Photographic Prints

Ilford Ilfochrome Classic Deluxe Polyester-Base		29 years**
Ilford Ilfochrome RC-Base Prints		29 years**

** Data based on tests completed in 1992 with Ilford Cibachrome

Notes:

- 1) Paper available from Dia-Nielsen USA, Inc.: 856-642-9700
- 2) Cerographic Giclée Prints: www.opaate.com
- 3) Ataraxia Studio Collectors Color Prints: www.atxstudio.com

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Inks and Media for Iris Graphics Printers: Years of Print Display Before Noticeable Fading Occurs

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Iris Graphics Equipoise Inkset

Arches Cold Press Paper	32–36 years
Fredrix TaraJet Canvas (glossy)	23–27 years
Somerset Velvet Paper	20–24 years
UltraStable Canvas (glossy)	18–22 years
Bulldog Photo Rag Paper	18–20 years
Bulldog Ultra Gamut Canvas (glossy)	16–18 years
Parrot Bright White Watercolor Paper	16–18 years
Iris Canvas	16–18 years
Parrot Premium Matte Canvas	16–18 years
Parrot Premium Gloss Canvas	13–15 years
Parrot Prem. Semi-Matte Photobase	13–15 years
Arches for Iris Paper	13–15 years
Parrot Premium Gloss Photobase	11–13 years
Lysonic Standard Fine Art Paper	7–9 years
Liege Inkjet Fine Art Paper	2–3 years
Somerset Velvet Enhanced Paper	(tests in progress)

Lysonic i W-2 Inkset*

Lysonic Standard Fine Art Paper	28–32 years
Lysonic Soft Fine Art Paper	(tests in preparation)
Lysonic Rough Fine Art Paper	(tests in preparation)
Weber-Valentine Guardian GWCS250	(tests in progress)
Luminos Lumijet DW Glossy Paper	(tests in preparation)
Arches Cold Press Paper	(tests in preparation)
Somerset Velvet Paper	(tests in preparation)
UltraStable Canvas (glossy)	(tests in preparation)
Fredrix TaraJet Canvas (glossy)	(tests in preparation)
Somerset Velvet Enhanced Paper	(tests in progress)

Lyson/Iris WH-2 Hybrid Inkset (Iris ID C; FA-II M; FA Y+B)

Arches Cold Press Paper	32–36 years
Somerset Velvet Paper	20–24 years
Arches for Iris Paper	20–24 years
Iris Canvas	10–12 years
Liege Inkjet Fine Art Paper	2–3 years

Lyson/Iris WH-3 Inkset (Iris ID C; Lyson FA-II M; 005Y; FA B)

Somerset Velvet Paper	65–75 years
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American Ink Jet Pinnacle Gold Iris Inkset

Somerset Velvet Paper	65–75 years
Arches Cold Press Paper	60–70 years

American Ink Jet Omnitone Iris Inkset (Monochrome)

Arches Cold Press Paper	(tests continuing)	>60 years
Somerset Velvet Paper	(tests continuing)	>60 years

ConeTech Wide Gamut Fine Art (WGFA) Inkset

Somerset Velvet Paper	[tentative]	20–24 years
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AIJ/Lyson WH-5 Hybrid Inkset (AIJ C+M; Lyson FA Y+B)

Somerset Velvet Paper	4–6 years
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AIJ/Iris WH-6 Hybrid Inkset (AIJ C+M; Iris ID Y+B)

Somerset Velvet Paper	3–5 years
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Iris Graphics Industrial Design (ID) Ink Set

Arches Cold Press Paper	[tentative]	2–3 years
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Iris Equipoise Black Ink (Only) in Monochrome Prints

Somerset Velvet Paper	(tests continuing)	>150 years
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***Note:** The “Lysonic i W-2 Inkset” for Iris printers is the Wilhelm Imaging Research designation for a Lyson inkset optimized for use with Lysonic Standard, Lysonic Rough, and Lysonic Soft Fine Art papers; the W-2 inkset may also be used with other papers. The W-2 inkset consists of Lysonic i Cyan (Exp. 006); Lysonic i Magenta; Lysonic i Yellow (Exp. 005); and Lysonic i Black (Neutral). For further information, see Mark McCormick-Goodhart’s article about the W-2 inkset at: www.wilhelm-research.com. Stability data for the Lysonic i W-2 inkset and all other inksets formulated for Iris printers **ARE NOT** applicable to inksets formulated for Epson, Encad, and other inkjet printers.

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