

With New Pigmented Inks, Dye-Based Inks, and Inkjet Papers, An Unprecedented New Era Has Begun in Color Photography

By Henry Wilhelm
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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 with dye-based inks especially, the choice of media can be every bit as critical as it is with image quality (refer to the data on the following pages). 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 humidity-fastness, water-resistance, and susceptibility to image degradation caused by ozone and other airborne contaminants.

In the early 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. Until very recently, all of the photo quality inkjet printers on the market had evolved from office text printers. Readable black text and colorful graphs and pie charts

printed on plain paper was the goal. Most of the inksets 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. A very good benchmark for evaluating the stability of an inkjet print 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. Fujicolor Crystal Archive paper is serious, long-lasting photography.

Rather suddenly, Epson, Hewlett-Packard, Canon, and Lexmark found themselves in a whole new field – serious amateur and professional photography! Epson was the first major inkjet printer manufacturer to really understand what the photography market was all about and in March 2000 the company introduced the Epson Stylus Photo 870 and 1270 printers and its first ever dye-based inkset and matched photo papers to provide both enhanced light fading stability and humidity-fastness.

Two months later, in May 2000, Epson announced three new 6-ink photo printers: the Epson Stylus Pro 7500 (a 24-inch sheet and roll-fed printer); the Epson Stylus Pro 9500 (a 44-inch sheet and roll-fed printer); and the Epson Stylus Photo 2000P, an affordable 13x19-inch sheet and roll-fed desktop photo printer.

All of these printers were designed to use new “Epson Archival Ink,” a highly stable, fully pigmented inkset which extensive tests conducted with prototype inks and media at Wilhelm Imaging Research indicate will last more than 100 years – and, depending on the particular type of media, likely more than 200 years – when displayed under glass in typical indoor display conditions before noticeable fading will occur. Fully pigmented, high stability inksets are also available for wide-format printers supplied by Roland, Hewlett-

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Packard, Encad, ColorSpan, and other manufacturers, but the Epson 2000P is the world's first desktop printer to be designed exclusively for high stability pigmented inks.

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 – with correspondingly less white space – in medium- and low-density portions of an image than do four-ink printers.

Another important advance in inkjet printing is the development of the new high-stability monochrome inksets introduced by American Ink Jet Corporation, Lyson Ltd., and Cone Editions Press, Ltd. These new inksets, designed to overcome the many problems inherent in printing monochrome images with full-color CMYK inksets, include the AIJ Friesian Monochrome inks for Epson printers; Lyson SterlingSilver hue-adjustable monochrome inks for Epson and Iris printers; Lysonic E Quad Monochrome inks for Epson printers; Cone Editions Press, Ltd. PiezographyBW monochrome inks for Epson printers; and AIJ Omnitone Iris hue-adjustable inks for Iris printers.

With Epson printers having achieved overwhelming dominance in the photo printer market segment, it is expected that, to stay competitive, the other major printer manufacturers will also introduce improved printers with new, longer-lasting photo inksets and media.

The evolution of inksets for the Iris printer, introduced in the mid-1980's, followed a path similar to that of the desktop field. Iris machines, which can print images as large as 34 x 46 inches, were designed for direct digital proofing, making comps, and technical applications. These of course are throw-away things, not photographs or works of art. The initial inksets provided by Iris Graphics were never intended for making prints to be matted, framed, and displayed in the same way as traditional color photographs and other fine art prints. This gap in the market led to the development of "archival" dye-based inksets with improved stability – the Lyson Fine Arts inkset introduced in 1994 for the Iris printer was the first.

This was followed by a series of improved Lyson inksets for the Iris; by the Iris Equipoise inkset marketed by Iris Graphics, and, most recently, by the AIJ Pinnacle Gold Iris inkset produced by the American Ink Jet Corporation.

Adobe Photoshop and other digital image processing software has given photographers complete control over image contrast and color saturation – two critical aspects of image quality over which there is no control whatsoever when making prints on traditional color papers with an enlarger. Digital dodging, burning, and dust and scratch elimination can now be precisely and easily done at the micro-level, under high magnification.

Excellent prints can also be made from digital files with Fujicolor Crystal Archive paper and other traditional color papers using RA-4 wet-chemistry processing, however, using Cymbolic Sciences LightJet digital printers and Durst Lambda digital printers – both 50-inch wide digital RGB laser imaging devices – and other digital photo paper printers.

The time-honored tradition of Ansel Adams, Edward Weston, Eugene Smith, Paul Caponigro, Lee Friedlander, and other serious photographers making their own prints was for the most part lost to photographers who chose to work in color. When the widespread adoption of color photography in the late 1960's largely displaced black-and-white photography among amateurs and with professional portrait and wedding photographers, the darkroom did not survive the change. Color darkrooms were too complicated, too expensive, and far too time-consuming to be practical for most photographers working in color and they had no choice but to have others make their prints.

Photoshop and inkjet photo printers have finally made the home "color darkroom" possible. For the first time ever, photographers at all levels – from the casual snaphooter to the most accomplished fine art and professional photographers – now have the ability to make their own high-quality color prints.

On the desktop, the \$899 Epson Stylus Photo 2000P printer with its 6-ink pigmented "Archival Ink" and matched photo papers provide an affordable combination of excellent image quality, a wide color gamut, and extremely good image permanence that has not previously been available in the entire 125-year history of color photography. High-stability pigmented inks – and indeed, color photography itself – have now truly come of age!

Inks and Media for Desktop Inkjet Printers (page 1 of 2) Years of Print Display Before Noticeable Fading Occurs

For Members of the International Association of Fine Art Digital Printmakers
Distributed at the March 1999 IAFADP Meeting in New York – Updated June 20, 2000

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Desktop Inkjet Printers (current products)

Epson Stylus Photo 2000P Printer (Pigmented Archival inks)	
Epson Smooth Fine Art Paper by Crane	(tests in progress) ⁽¹⁾
Epson Textured Fine Art Paper	(tests in progress) ⁽¹⁾
Epson Archival Matte Paper	(tests in progress) ⁽¹⁾
Epson Premium Semigloss Photo Paper	(tests in progress) ⁽¹⁾
Epson Premium Luster Photo Paper	(tests in progress) ⁽¹⁾

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

Lexmark Z51 Color Jetprinter (Lexmark 12A1990 Photo inks)

Lexmark Photo Paper (1998 “original” type)	2–3 years
Lexmark Photo Paper (1999 “new” type)	< 1 year
Kodak Inkjet Photo Paper (1999 “new” type)	< 6 months

Canon BJC-8200 Photo Printer (Canon inks)

Canon Glossy Photo Paper GP-301	< 6 months
Canon High Gloss Photo Film GP-201	< 6 months
Canon Photo Paper Pro PR-101 (new in 1999)	< 1 year

1) The new 6-ink Epson Stylus Photo 2000P printer uses the newly developed “Epson Archival Inks” – a fully pigmented, high stability inkset. Extensive accelerated light fading tests conducted by Wilhelm Imaging Research, Inc. with prototype Epson Archival inks and Epson media indicate that prints made with the new Epson inks, framed under glass, should **exceed 100 years of display** at an illumination level of 450 lux for 12 hours per day before noticeable fading occurs. Depending on the specific media type, prints made with the new inks will likely **exceed 200 years of display**, based on these ongoing accelerated light fading tests.

3) 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:

- a) Ink Bleeding (gradual lateral ink diffusion)
- b) Density Changes (increases or decreases)
- c) Color Balance Changes
- d) “Bronzing” in High Density Areas
- e) Sticking and Ink Transfer

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

Desktop Inkjet Printers (current products)

Epson Stylus Photo 870 and 1270 Printers (Epson inks)

Epson Matte Paper – Heavyweight	24–26 years
Epson Premium Glossy Photo Paper	9–10 years ⁽²⁾
Epson Photo Paper	6–7 years

Hewlett-Packard PhotoSmart P1000 and P1100 Printers

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

Hewlett-Packard DeskJet 970C and 1220C Printers

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

2) Note: There have been some field reports that prints made with Epson Premium Glossy Photo Paper have experienced premature cyan dye fading when they have been displayed unframed and freely exposed to the surrounding atmosphere. Information supplied by Epson, investigation and experimental work conducted by Wilhelm Imaging Research, field reports, and data gathered from other sources indicate that this paper has a particular sensitivity to ozone, nitrogen and sulfur oxides, and certain other airborne contaminants which, when concentrations are high enough and the print is not protected from the open atmosphere, may cause rapid fading of the cyan ink; this typically results in the color balance of the prints shifting toward red/orange. Indoor sources of ozone and other airborne contaminants include electrostatic (“electronic dust precipitators”) air filtration equipment installed in some central heating and air conditioning systems in homes, office buildings, restaurants, and other public buildings to remove dust, tobacco smoke, etc. (electrostatic air filtration units are also supplied as small “tabletop” devices); cooking fumes, especially from gas stoves; automobile exhaust; urban air pollution; etc. This type of premature ink fading is NOT caused by exposure to light. In situations where this type of fading has been experienced, prints made with Premium Glossy Photo paper should be dried for 24 hours with a sheet of ordinary paper placed on top of the print. **These prints as well as all inkjet prints and traditional photographs should always be displayed under glass**, or placed in albums or other closed containers to protect them from the open atmosphere. Prints made with Epson Matte Paper – Heavyweight appear to have a much higher resistance to this type of “gas fading” as well as having superior light fading stability. Epson Matte Paper – Heavyweight is recommended in all applications where maximum permanence is desired. The resistance of Epson Photo Paper to “gas fading” is also superior to that of Epson Premium Glossy Photo Paper. Investigation of the “gas fading” phenomenon with various types of inkjet prints and other imaging materials is continuing.

Inks and Media for Desktop Inkjet Printers (page 2 of 2) Years of Print Display Before Noticeable Fading Occurs

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Desktop Inkjet Printers

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 ⁽³⁾
HP 722C w/HP Deluxe Photo Paper (HP/EK)	1 year ⁽³⁾
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
Polaroid Premium Quality Photographic Paper	3 years
Mitsubishi Artist Mirror Gloss Heavy Paper	2 years ⁽³⁾
Epson Photo Quality Glossy Film	1.5 years ⁽³⁾
Imation Photographic Quality Paper	1.5 years ⁽³⁾
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 ⁽³⁾
Konica Photo Quality Inkjet Paper QP (1998)	0.6 years ⁽³⁾

Lysonic E Inks for Epson 3000 4-ink Printers

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

Lysonic E Inks for Epson 5000 6-ink Printers

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

3) Products Having Poor Humidity Fastness: These products are not recommended for long-term home use or professional applications – see **Note 3** on previous "Desktop Inkjet Printers" page.

Desktop Inkjet Printers

Xtreme Gamut Inks for Epson 3000 4-ink Printers

Xtreme Gamut Gloss (polyester base)	(tests in progress)
Xtreme Gamut Reflection Glossy	(tests in progress)
Arches Cold Press Paper	(tests in progress)
Somerset Velvet Paper	(tests in progress)

AIJ Pinnacle Gold Epson Inks for Epson 3000 Printers

Arches Cold Press Paper	(tests in progress)
Somerset Velvet Paper	(tests in progress)
Epson Photo Paper	(tests in progress)

Lyson Tiara Inks for Epson 5000 6-ink Printers

(Pigment-dye hybrid inkset)

Lysonic Standard Fine Art Paper	(tests in progress)
Lysonic Soft Fine Art Paper	(tests in progress)
Lysonic Rough Fine Art Paper	(tests in progress)
Arches Cold Press Paper	(tests in progress)
Somerset Velvet Paper	(tests in progress)
UltraStable Canvas (glossy)	(tests in progress)
Epson Photo Paper	(tests in progress)

Lyson Fotonic Inks for Epson 3000 4-ink Printers

Arches Cold Press Paper	(tests in preparation)
Bulldog Photo Rag Paper	(tests in preparation)
Somerset Velvet Paper	(tests in preparation)
UltraStable Canvas (glossy)	(tests in preparation)
Lysonic Standard Fine Art Paper	(tests in preparation)
Epson Photo Paper	(tests in preparation)

MediaStreet Generations II Inks for Epson 3000 Printers

(Pigmented inkset)

MediaStreet Royal Plush Paper	(tests in preparation)
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MediaStreet Generations II Inks for Epson 5000 Printers

(Pigmented inkset)

MediaStreet Royal Plush Paper	(tests in preparation)
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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 & Digital Photo Paper Prints (page 1 of 2) Years of Print Display Before Noticeable Fading Occurs

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Current Photographic Color Negative Prints

Fujicolor Crystal Archive Paper	60 years*
Kodak Ektacolor Edge 8 Paper	(tests in progress)
Kodak Ektacolor Edge 7 and Royal VII Papers	18 years
Kodak DuraLife Paper (1999 type)	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

Photographic Backlit Display Materials (indoor display)

Fujitrans Crystal Archive Display Material	(tests in progress)
Kodak Duratrans Prof. Display Material	(tests in progress)
Agfatrans XA Display Material	(tests in progress)
Ilford Ilfocolor Translucent Display Film	(tests in progress)

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

Fuji Pictography 3000/4000 Digital Color Prints

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

RC-Base Pictography Paper	(tests in progress)
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Ataraxia Studio Collectors Color Prints⁽¹⁾

(Pigment-Gelatin Digital Print Process)

White Polyester-Base Prints	(tests continuing) >300 years
RC-Base Photographic Paper	>100 years

Cerographic Giclée Prints⁽²⁾

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

Notes:

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

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) >140 years
Dr. Graphix Pure White Canvas	>100 years
HP Heavyweight Coated Paper	>100 years
Hahnemühle Albrecht Dürer Paper	(tests continuing) >150 years ⁽³⁾
Hahnemühle William Turner Paper	(tests continuing) >100 years ⁽³⁾
Somerset Velvet Enhanced Paper	(tests in progress)

Inkjet Backlit Display Materials (indoor display)

HP Colorlucent Backlit UV Printing Material	(tests in progress)
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Inkjet Backlit Display Materials (outdoor display)

HP Colorlucent Backlit UV Printing Material	(tests in progress)
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Photographic Backlit Display Materials (outdoor display)

Kodak Duratrans Digital Display Material	(tests in progress)
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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, Natural White	120–130 years
PQM Super Hi-Gloss White Film	(tests in progress)
Legion Concorde Rag Paper, Bright White	(tests in preparation)

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

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Encad GA Dye-Based Inks for Encad NovaJet Printers

Encad QIS Photo Glossy Paper	1–2 years
Encad QIS Canvas	1–2 years

Encad GS Dye-Based Inks for Encad NovaJet Printers

Encad QIS Photo Glossy Paper	1–2 years
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Encad GO Pigmented Inks for Encad NovaJet Printers

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

Kodak EI LightFast Inks for Kodak and Encad Printers*

Kodak EI Glossy Vinyl Adhesive Print Material	>110 years
Kodak EI Photographic Glossy PrintPaper	75–80 years
Kodak EI Photographic Matt PrintPaper	52–56 years
Kodak EI Economy Semi-Glossy PrintPaper	24–28 years
Kodak EI Photographic Satin PrintPaper	24–28 years
Kodak EI Self-Adhesive PrintPaper	11–13 years
Kodak EI Backlit Film	(tests in progress)

*Dye-based inks for Kodak LFP 2042/2060
and Encad NovaJet Pro 36/50 printers

AIJ UV Gold Dye-Based 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 NovaJet Printers

Ilford Ilfojet Photo Glossy Paper	70–80 years**
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**Note: Tested only with Ilfojet Photo Glossy paper; other
types of paper may prove to be significantly less stable.

Epson Archival Pigmented Inks for Epson 9500 Printers***

Epson Smooth Fine Art Paper by Crane	(tests in progress)
Epson Textured Fine Art Paper	(tests in progress)
Epson Premium Semigloss Photo Paper	(tests in progress)
Epson Premium Luster Photo Paper	(tests in progress)
Epson Premium Semimatte Paper	(tests in progress)
Epson Artists Canvas	(tests in progress)

Epson Archival Pigmented Inks for Epson 7500 Printers***

Epson Smooth Fine Art Paper by Crane	(tests in progress)
Epson Textured Fine Art Paper	(tests in progress)
Epson Premium Semigloss Photo Paper	(tests in progress)
Epson Premium Luster Photo Paper	(tests in progress)
Epson Premium Semimatte Paper	(tests in progress)
Epson Artists Canvas	(tests in progress)

AIJ Pinnacle Gold Epson Inks for Epson 9000 Printers

Pinnacle Gold Enhanced Watercolor Paper	36–40 years
Arches Cold Press Paper	28–30 years
Somerset Velvet Paper	8–10 years
Parrot Premium Gloss Paper	(tests in preparation)
Parrot Premium Matte Paper (7 mil)	(tests in preparation)
Parrot Premium Gloss Canvas	(tests in preparation)

MediaStreet Generations Pigmented Inks for Epson 9000

MediaStreet Royal Plush Paper	(tests in preparation)
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***Note: Both of these new 6-ink photo printers use the newly developed “Epson Archival Inks” – a fully pigmented, high stability inkset. Long-term accelerated tests conducted by Wilhelm Imaging Research, Inc. with prototype Epson Archival inks and Epson media indicate that prints made with the new Epson inks, framed under glass, should **exceed 100 years of display** at an illumination level of 450 lux for 12 hours per day before noticeable fading occurs. Depending on the specific media type, prints made with the new inks will likely **exceed 200 years of display**, based on these ongoing accelerated light fading tests.

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Inks and Media for Monochrome Inkjet Printing

Years of Print Display Before Noticeable Fading Occurs

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Epson 4-Ink Printers

AIJ Friesian Monochrome Inks for Epson 3000 Printers

Epson Photo Paper	(tests continuing) >100 years
Somerset Velvet Paper	70–80 years

Lysonic E Quad Neutral Inks for Epson 3000 Printers

Lysonic Standard Fine Art Paper	(tests continuing) >100 years
Somerset Velvet Paper	(tests continuing) >100 years
Epson Photo Paper	80–90 years

Lysonic E Quad Sepia Inks for Epson 3000 Printers

Lysonic Standard Fine Art Paper	80–90 years
Somerset Velvet Paper	55–60 years
Epson Photo Paper	15–20 years

Lyson SterlingSilver Monochrome Inks for Epson 860/1160

Lysonic Standard Fine Art Paper	(tests in progress)
Lysonic Soft Fine Art Paper	(tests in progress)
Lysonic Rough Fine Art Paper	(tests in progress)
Hahnemühle William Turner Paper	(tests in preparation)
Legion Concorde Rag Paper	(tests in preparation)
Somerset Velvet Paper	(tests in progress)
Arches Cold Press Paper	(tests in progress)
UltraStable Canvas	(tests in preparation)
Fredrix TaraJet Canvas (glossy)	(tests in preparation)

Lyson SterlingSilver Monochrome Inks for Epson 3000

Lysonic Standard Fine Art Paper	(tests in preparation)
Lysonic Soft Fine Art Paper	(tests in preparation)
Lysonic Rough Fine Art Paper	(tests in preparation)
Hahnemühle William Turner Paper	(tests in preparation)
Legion Concorde Rag Paper	(tests in preparation)
Somerset Velvet Paper	(tests in preparation)
Arches Cold Press Paper	(tests in preparation)
UltraStable Canvas	(tests in preparation)
Fredrix TaraJet Canvas (glossy)	(tests in preparation)

Iris Graphics 3024/3047/3047G Printers

American Ink Jet Omnitone Iris Inkset (Monochrome)

Arches Cold Press Paper	(depending on hue) 100–150 years
Somerset Velvet Paper	(depending on hue) 75–125 years

Lyson SterlingSilver Iris Monochrome Inkset

Lysonic Standard Fine Art Paper	(tests in preparation)
Hahnemühle William Turner Paper	(tests in preparation)
Somerset Velvet Paper	(tests in preparation)
Arches Cold Press Paper	(tests in preparation)
UltraStable Canvas	(tests in preparation)
Fredrix TaraJet Canvas (glossy)	(tests in preparation)

Traditional Black-and-White RC Prints Have a Long History of Serious Stability Problems and Should Be Avoided

Experience in the field during the almost 30 years that have passed since the introduction of black-and-white photographic papers made with polyethylene coated RC (“resin-coated”) paper base in 1972 has shown that prints made with these papers – including current products – can suffer from a variety of potentially catastrophic stability-related shortcomings. These problems include: light-induced image discoloration; “red spot” formation; areas of surface “silver-mirroring” (often located adjacent to sharp density gradients); overall yellowing of the prints; light-induced cracking; cracking that can occur in the dark as a result of fluctuations in temperature and/or humidity; and, with certain papers, brownish discoloration of the paper base caused by incorporated developers that have migrated into the paper core prior to processing. Fiber-base black-and-white prints are not subject to similar light-induced image deterioration; they generally are very stable.

Valuable black-and-white RC prints should never be displayed. To safeguard the prints, they should be kept in the dark in a cool and dry place. Available information indicates that the overall image stability of both monochrome inkjet prints and current color negative prints supplied by Fuji, Kodak, and Konica are greatly superior to that of black-and-white RC prints, both when prints are exposed to light on display – and when kept in albums.

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 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

Inks and Media for Iris Graphics Printers

Years of Print Display Before Noticeable Fading Occurs

For Members of the International Association of Fine Art Digital Printmakers
Distributed at the March 1999 IAFADP Meeting in New York – Updated June 20, 2000

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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 Paper	11–13 years
Lysonic Standard Fine Art Paper	7–9 years
Somerset Enhanced Velvet Paper	2–3 years*
Liege Inkjet Fine Art Paper	2–3 years*

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 Enhanced Velvet Paper	3–4 years*

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*

American Ink Jet Pinnacle Gold Iris Inkset (new in 2000)

Somerset Velvet Paper	65–75 years
Arches Cold Press Paper	60–70 years
Arches for Iris Paper	30–34 years
Iris Canvas	24–28 years
Pinnacle Gold Enhanced Watercolor Paper	22–26 years
UltraStable Canvas (estimated; tests in progress)	18–20 years
Bulldog Ultra Gamut Canvas (glossy)	(tests in progress)
Parrot Premium Bright White Watercolor	(tests in preparation)
Parrot Premium Matte Canvas	(tests in preparation)

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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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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***Note:** Legion West Paper, Inc., the distributor of Somerset Enhanced Velvet Paper and Liege Inkjet Fine Art Paper, recommends that the papers not be used for Iris fine art prints or other Iris printing application requiring extended storage or display.

****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, please see Mark McCormick-Goodhart’s article about the Lysonic I 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.

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. Print coatings tested to date have shown little if any benefit in terms of prolonging the display life of Iris inkjet prints (also known as Giclée prints); with some ink/paper/coating combinations, the coatings have even proven to be harmful to image stability. ©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