

DIGITAL FINE ART PRINTING

1990 saw the introduction of the first commercially available digital camera, the Dycam Model 1, which was quickly followed by the Kodak DCS-100 in 1991. That same year, Nash Editions was founded in Manhattan Beach, California to produce digital prints of fine art photographs. They were the first digital fine art photography printing company and their first printer was the Iris 3047.

Iris Prints

Iris prints were originally meant to be used as printers' proofs that could match the color gamut and tonal qualities of offset printing. These inkjet printers produced large, high quality photographic prints, however the prints were not originally intended for long-term use. Nash Editions and the handful of other fine art photography printers who had sprung up across the country soon became concerned about the stability of these prints.

The industry responded with dye-based inksets with improved longevity for Iris printers, but this longevity was still limited to a few years. Eventually, newer inksets and improved substrates were developed that extended the life of the prints up to 70 years (Footnote #1). Still, because of the special continuous-flow inkjet head and nozzle design of these printers, only dye-based inks could be used. The stability of dye-based inks is far more influenced by the media and receptiveness of the ink surface than pigmented inks, which can be printed on a wide range of both matte and glossy-surface substrates.

C-Prints

Where do c-prints fit into all of this? The c-print, or chromogenic-print, made color prints widely available. To make a c-print, a dye is used that can transform from a colorless to a color state. The few dyes that can do this transformation are chromogenic and, because of this very ability, they are the least lightfast of dyes.

By 1995, the Durst Lambda provided a way to make c-prints digitally, improving the quality that could be achieved with a traditional enlarger. There are two methods used to create digital c-prints: a CRT, or cathode ray tube, is used to expose the paper and is generally used at large, centralized labs aimed at the general consumer, while laser-imaging (Durst Lambda and Cymbolic Sciences LightJet) is used for higher-quality prints up to 72" wide. (Laser exposes the paper directly, creating a better image.) Some labs have equipment for both methods and decide on the mode they use, depending on the type of job they receive. Because it is a digital route, a c-print can be digitally enhanced, color-controlled, and color rich.

Pigment Ink Prints

In 1999, Epson introduced their new Stylus Pro 9500 large-format printer, which was able to use archival pigment inks, but had a limited color gamut and pigments that were lightfast, but had an inconsistent response to different light sources (known as metamerism failure). It wasn't until Epson came out with the 2400, 7800 and 9800 printers, with the introduction of their UltraChrome K3 (8-color) inksets that metamerism was all but eliminated. Pigment ink prints are now available with a color gamut and subtlety that surpasses either Iris prints or c-prints. With 3 levels of black ink, the colors and appearance of true black-and-white silver-gelatin prints can be replicated.

C-Prints or Pigment Ink Prints?

While c-prints have a smaller color gamut than the latest pigment ink prints, this does not make a difference for 90% of photographic projects. They have shorter print-permanence than pigment ink printing, but the advantages lie in cheaper materials and a more scalable processor. Large photolabs can produce huge quantities of prints faster and more cheaply than most inkjet printers. For many commercial applications, these are huge advantages.

Using the latest pigment ink printers, digital prints now have a finer level of detail, smoother gradation, deeper blacks, and a wider color gamut than c-prints. Pigment ink prints have a wider selection of substrates that they can be printed on; the many options for bright white or natural papers means that perfectly neutral and toned black and white images can be created. Longevity is the primary advantage: the best archivally printed c-prints have a maximum longevity of 40-65 years, while for pigment ink prints, maximum longevity is more than 200 years. Challenges remain for the pigment ink printing process to increase the speed and reduce the cost of producing prints.

In the fine art market, not only the quality of the object, but the archival qualities of an object – and therefore the continuing value of a work of art – are a serious consideration. To date, the best methods for producing fine art photography are traditional silver-gelatin prints and pigment ink prints.

DISPLAY PERMANENCE RATINGS AND ALBUM/DARK STORAGE PERMANENCE RATINGS

(Years Before Noticeable Fading And/Or Changes In Color Balance Occur)

Print Type	Displayed Prints Framed Under Glass	Displayed Prints Framed With UV Filter	Album/Dark Storage Rating at 73° & 50% RH (incl. paper yellowing)
<p>C-PRINTS Fujicolor Crystal Archive (Footnote #2)</p> <p>Kodak Edge Generations (Footnote #3)</p>	<p>40 years</p> <p>19 years</p>	<p>50 years</p> <p>18 years</p>	<p>>100 years</p> <p>>100 years</p>
<p>PIGMENT INK PRINTS</p> <p>Epson UltraChrome K3 pigmented inks on archival paper (Footnote #4)</p> <p>Canon Lucia pigmented inks on Canon Photo Paper Plus Semi-gloss SG-201 (Footnote #5)</p> <p>Epson 11880, depending on substrate (Footnote #6)</p>	<p>61 - 108 years, depending on paper used</p> <p>>104 years</p> <p>61 - >406 years</p>	<p>125 - 175 years</p> <p>>190 years</p> <p>98 – >450 years</p>	<p>>300 years on Epson UltraSmooth Fine Paper</p> <p>>300 years</p> <p>110 – >300 years</p>

1 *A 15-Year History of Digital Printing Technology and Print Permanence in the Evolution of Digital Fine Art Photography – From 1991 to 2006*, by Henry Wilhelm, Wilhelm Imaging Research, Inc., p. 310, presented at NIP22: The 22nd International Conference on Digital Printing Technologies on September 19, 2006.

2 *A Survey of Print Permanence in the 4x6-Inch Consumer Digital Print Market in 2006-2007*, by Henry Wilhelm, Wilhelm Imaging Research, Inc., p. 2, presented at the IS&T's International Symposium on Technologies for Digital Fulfillment on March 5, 2007.

3 Wilhelm, p. 2, March 5, 2007.

4 Wilhelm, p. 311, September 19, 2006

5 *Canon PIXMA Pro9500 – Print Permanence Ratings (preliminary)*, by Henry Wilhelm, Wilhelm Imaging Research, Inc., p. 1, December 28, 2007.

6 *Epson Stylus Pro 11880 – Print Permanence Ratings*, by Wilhelm Imaging Research, Inc., February 29, 2008.

NOTE: All references can be found at www.wilhelm-research.com.