

## PHOTOGRAPHS

### 5.2.3 Types of Photographs, part 3: Digital Output Media

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#### INTRODUCTION

This leaflet introduces the basic types and processes of digital output media and serves as a primer for the identification of these materials. Further readings, such as NEDCC's preservation leaflets [5.4 Creating Long-lasting Inkjet Prints](#) and [5.5 Storage Enclosures for Photographic Materials](#), and resources listed below provide more information on the care and identification of digital output media.

#### PRINTING TECHNOLOGIES

There are a variety of output devices that can be used to print digital image files. The most common ones include the digital photo process, dye sublimation, electrography, and the inkjet, which came into significant use in 1998.

The *photothermographic transfer* (examples include the Fuji Pictography) is a high-end, large-format device used in many photo labs to print snapshots. The process, a combination of photographic and thermal dye diffusion methods, involves exposing a sheet of photosensitive "donor" paper to laser diodes (LD). Small amounts of water or heat are applied to create the dye image on the donor paper, which is then transferred to the "receiving" paper with a combination of heat and pressure. The receiving paper with its transferred dyes is peeled off and separated from the donor paper.

The *digital silver halide process* (examples include Lambda and Kodak Pegasus) uses light sensitive paper exposed by lasers or LEDs and then chemically processed. There is no negative

involved. It is still a wet process and is considered a chromogenic color print.

*Dye sublimation*, used by desktop units by Canon Selphy, and kiosk printers by Kodak Picture Maker, work with a single-color ribbon containing dye heated by a special head that runs the width of the paper. When the head heats up, it vaporizes (sublimates) the dye in that location. The dye, now in gaseous form, is absorbed into the paper. Since the paper receives the dye layers separately, the print can result in a smooth, seamless image.

*Electrography* includes laser prints and photocopies. In this process, the toner is transferred to an uncoated paper base then fused into place. The images composed of pigment particles are generally stable but are not often used for photo-quality printing.

*Inkjet* is the most widely used printing technology for digital fine art prints. Inkjet systems are based on the flow of colored ink from a nozzle that is deposited on a support to form an image. There are two types of technologies for inkjet printers: continuous flow and drop-on-demand or impulse jet. The IRIS printer and popular Epson Stylus® Photo printers are the best known of these systems.

Continuous-flow inkjet printers use an electrostatic charge to push ink out of the printhead reservoir. As the ink droplets are released, charged droplets are deflected and recycled while the uncharged particles spray a continuous stream of microscopic

ink droplets onto a flat substrate. The IRIS printer is an example of the continuous-flow printer.

The other type of printer, drop-on-demand, uses only ink droplets needed to form the image produced. There are two main types: thermal and piezoelectric. The thermal process, used by the Canon Bubble Jet Printer, is based on heating a resister in the printhead. As the printhead heats up, a bubble is produced and the increased pressure inside the printhead chamber forces the ink droplet out. After the bubble collapses, more ink is drawn from the reservoir. The piezoelectric effect (employed by Epson printers) uses a crystalline material inside the printhead reservoir to create an electric field, which produces the pressure instead of heat to release the ink.<sup>1</sup>

**DEFINITIONS**

First, a few useful terms and concepts:

**Coated paper:** paper that has coatings (microporous or swellable) which aid in receiving inks, create higher color-range




for pigment inks, and create better image quality as well as greater brightness and ink stability.

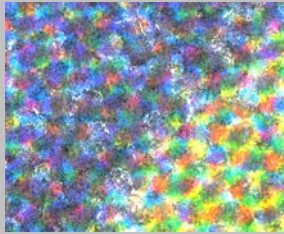

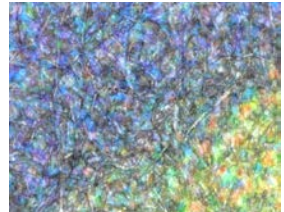
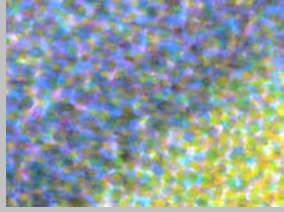
**Gloss Differential:** Variation in gloss across the surface of the print.

**Satellites:** Unintended specks or drops of colorant outside the printed dot shape.

**IDENTIFICATION**

To identify the printing technology used to make a digital print, examine the dot formation or image grain under magnification using a 60-120X LED lighted pocket or hand-held microscope (for example, the [Carson MicroBrite Plus](#)). View the print at 30X magnification and compare it to the examples below. Other distinguishing characteristics include the print’s primary uses and format, and the gloss differential.

Technique and Date	Processors/Typical Printers	Type of Dot Formation or Image Grain	Primary Uses/Formats	Key Identifying Features
Photothermographic Transfer (since 1987)	Fuji Pictography	 Fuji Film Pictography 4000 digital photo process on resin coated paper	<ul style="list-style-type: none"> <li>Digital lab systems</li> <li>Primary use: photography</li> <li>Formats: various - standard film and papers sizes are common</li> </ul>	<ul style="list-style-type: none"> <li>Diffuse or no image grain with lines</li> <li>No gloss differential</li> <li>Resin-coated support</li> <li>Matt to gloss surface - varies</li> <li>Paper fiber not visible</li> </ul>
Digital Silver Halide Process (since mid-1990s)	Lambda, Fuji Frontier, Océ Lightjet and Kodak Pegasus	 Océ Lightjet 430 - digital silver exposure to chromogenic paper	<ul style="list-style-type: none"> <li>No negative or enlarger</li> <li>Digital lab systems</li> <li>Primary use: photography</li> <li>Formats: various - standard film and papers sizes are common</li> </ul>	<ul style="list-style-type: none"> <li>Image grain</li> <li>No gloss differential</li> <li>Resin-coated support</li> <li>Possible faint lines from printer</li> <li>Matte to gloss surface - varies</li> <li>Paper fibers not visible</li> </ul>
Dye Diffusion Thermal Transfer Prints aka Dye sublimation (since 1986)	Desktop units - Canon Selphy or kiosk printers - Kodak Picture Maker	 Kodak Picture Maker kiosk - dye sublimation on resin-coated paper	<ul style="list-style-type: none"> <li>Primary use: kiosks and desktop units - photography only</li> <li>Formats: 8.5” x14” or smaller; usually 4”x6”</li> </ul>	<ul style="list-style-type: none"> <li>No dots or image grain</li> <li>Squares or lines visible</li> <li>No gloss differential</li> <li>Looks like a “true” photograph</li> <li>Resin-coated support</li> <li>Specks could be present due to dust during printing</li> </ul>

Technique and Date	Processors/Typical Printers	Type of Dot or Image Grain Formation	Primary Uses	Key Identifying Features
Electrography (Liquid toner since 1993; dry toner since late 1980s)	Laser printers - Hewlett Packard or Photocopiers	 <p>DocuColor™ Digital Color Press 6060 - Color dry toner on uncoated paper</p>  <p>Hewlett Packard Indigo 5000 -Color liquid toner on glossy coated paper</p>	<ul style="list-style-type: none"> <li>• Not used for photo-quality printing.</li> <li>• Primary uses: documents, short-run books and periodicals and postcards.</li> <li>• Formats: standard paper sizes; liquid toner HP Indigo 13"x 19" maximum</li> </ul>	<ul style="list-style-type: none"> <li>• Image composed of dots: dusty (dry toner) or clearly defined (liquid toner)</li> <li>• Four or more ink colors usually cyan, magenta, yellow and black</li> <li>• Satellites</li> <li>• Gloss differential between printed and non-printed areas</li> <li>• Paper fibers not visible</li> </ul>
Ink Jet (proofs since 1984; fine art prints since 1991)	Continuous flow – IRIS printers	 <p>IRIS 3047 - Continuous Tone Inkjet on fine art paper</p>	<ul style="list-style-type: none"> <li>• Primary uses: fine art prints and photography</li> <li>• Formats: various sizes with 35"x47" maximum</li> </ul>	<ul style="list-style-type: none"> <li>• Image composed of dot patterns of cyan, magenta, yellow and black (dye-based)</li> <li>• Subtle image pattern</li> <li>• Variable dot size – ink blends with paper</li> <li>• Uncoated or matte-coated fine arts papers</li> <li>• Gloss differential between printed and non-printed areas is rare – colors are within paper surface</li> </ul>
Ink Jet (varies but primarily since late 1980s)	Drop-on-Demand – Canon Pixma and Epson Stylus Pro Series	 <p>Epson Stylus Photo 4000 - Drop-on-Demand Inkjet on coated RC paper</p>	<ul style="list-style-type: none"> <li>• Primary uses: everything including books, periodicals, manuscripts, ephemera, photographs and fine art</li> <li>• Formats: various sizes</li> </ul>	<ul style="list-style-type: none"> <li>• Image composed of dot patterns of cyan, magenta, yellow and black (dye or pigment based)</li> <li>• Some ink sets may have additional lighter shades of colors</li> <li>• Dot structure is key Small uniform dots that may overlap</li> <li>• Glossier the print, rounder the dot</li> <li>• Gloss differential between printed and non-printed areas</li> </ul>

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## RESOURCES:

- Aardenburg Imaging Research. <https://www.aardenburg-imaging.com/research/>
- Image Permanence Institute. *Digital Print Preservation Portal*. <http://www.dp3project.org/>
- Image Permanence Institute. *Graphics Atlas*. <http://www.graphicsatlas.org/>
- Jürgens, Martin. *The Digital Print: Identification and Preservation*. The Getty Conservation Institute. 2009.
- NEDCC Preservation Leaflet [5.4 Creating Long-lasting Inkjet Prints](#).
- NEDCC Preservation Leaflet [5.5 Storage Enclosures for Photographic Materials](#).
- Wilhelm Imaging Research. <http://www.wilhelm-research.com/>

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