

# HyperPhoto: pushing back the frontiers in digital imaging print systems

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## Abstract

HyperPhoto is a new digital imaging and print system that combines the latest paper, printer, hardware and software technology to produce a truly state-of-the-art photographic print system.

Developed by Canon, its key features are its very fast full-color printing, outstanding output quality, durable media, flexible paper sizes and template driven GUI. Most importantly, HyperPhoto is designed to produce photographic quality printouts that will last as long as traditional silver halide prints.

Typical print speed is just under two minutes for a full color letter page. This landmark print speed is achieved through the use of customized hardware and software developed in Australia by Canon Information System Research Australia (CISRA).

The HyperPhoto printer utilizes Bubble Jet printing technology, with a six-color ink system that provides greater color precision and 1200 x 600 dpi resolution. The printer uses a special new paper technology that is UV light and water resistant so printouts do not fade.

HyperPhoto can accept images from both analog and digital sources. Its scanner has a scanning resolution of 2,223dpi for 35mm and APS cartridges and 300dpi for other printed material. Each 35mm frame is scanned in approximately 2 seconds. Auto-focusing and auto-exposure are also available.

As the world moves into digital photography, HyperPhoto has been developed to keep Canon at the forefront of that technology.

## Introduction

Over the last two years Canon has been developing HyperPhoto, a new digital imaging and print system.

The development of HyperPhoto has been a joint effort, combining the experience and skills of Canon Inc., Japan and Canon Information Systems Research Australia.

This paper describes the key components of HyperPhoto, highlighting input, output and internal processing. Independently, each component has powerful features that are designed to meet the demands of high quality digital image processing. When integrated together however, they combine to form a unique system that surpasses all digital imaging systems on the market today.

The system is based on a PC comprising 166Mhz Pentium processor, 64 Mbytes of RAM and 4 Gigabytes of disk space. The graphics performance is achieved through hardware acceleration utilizing an Application Specific Integrated Circuit (ASIC). This was designed at CISRA and at 380,000 gates, is the largest ASIC ever designed in Australia.

Canon envisages that HyperPhoto will be utilized in a broad range of retail environments from DPE through to Copy shops and on to business or corporate applications.

## Scanner and Digital Input Media

### The HyperPhoto Scanner

The HyperPhoto scanner is a new generation of scanner that has been designed to allow the most common analog media to be captured and processed in a straightforward and consistent way.

It supports 35mm positives and negatives, slides and APS cartridges. These are typically scanned within 2 seconds/frame at 2223 dpi.

The scanner also supports flat-bed scanning of postcards and panorama prints within 6 seconds at 300 dpi.

Auto-focusing and auto-exposure are also supported by the scanner.

### Digital Media

HyperPhoto supports the Canon PowerShot 600 and Canon EOS DCS3 digital cameras via a PCMCIA interface.

HyperPhoto also supports the most common digital image file formats such as FlashPix, TIFF, JPEG, JFIF, PhotoCD and BMP.

## Paper and Printer

Canon has developed a new paper technology that will compete with the traditional silver halide print process in terms of image quality and durability without having any of the drawbacks. The paper has a tri-layer structure which is reflective, absorbent and protective.

The base layer is highly reflective. This supports brighter colors, greater contrast and a broader range of colors than is normally possible with normal color printing paper.

The absorbent layer is composed of superfine transparent granules that absorb ink very quickly without scattering the light even when it is reflected. This provides better color saturation than that found in silver halide photographs. The speed of absorption is also necessary to allow for high print speed.

The top layer is composed of fine granules which are sealed thermally on output from the printer. So, once heated, the resultant print is highly resistant to the effects of scratches, water, ultraviolet light and ozone.

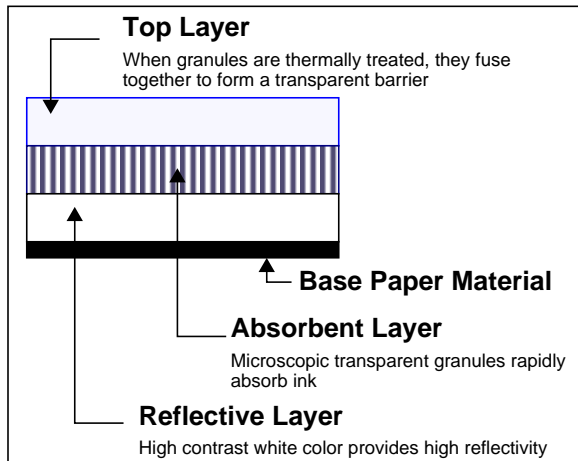


Figure 1: HyperPhoto's Tri-layer paper structure.

The paper is dry when ejected from the printer. It will keep its color consistency and remain durable for considerably longer than conventional ink-jet print technology.

HyperPhoto paper currently comes as roll stock 11.7" wide and cut sheet.

To complement this paper Canon has also developed a new printer. The printer is based on a 1200 x 600 dpi Bubble Jet print head with six-color ink system.

Paper sizes from postcard up to 11.7" X 49.5" are supported by the printer.

## OpenPage

OpenPage is a 2D rasterization tool that lies at the hub of HyperPhoto. It is both an image composition language and a Raster Image Processor (RIP). OpenPage's key features are its sophisticated graphics and compositing operators, low memory usage and fast printing speed, even when large high resolution images are used.

Unlike other page description languages that were developed for black and white and later modified to try to support color, OpenPage has been designed from the outset to support color. In addition to color management OpenPage also uses advanced memory management, transparency and image file format handling.

OpenPage has several features that are particularly useful for HyperPhoto. These are:

- All compositing operations can be performed on any graphic object, whether it be text, object graphics or pixel data
- Text and graphics are anti-aliased
- Image manipulation is resolution independent
- Image compression is an integral part of the RIP.

See figure 2 for a sample line drawing with background image showing some of the features of the language. Note that the Toucan is constructed using spline graphics only. The smooth color blends are achieved using edge blends. Similarly, figure 3 shows a Mandrill constructed solely from spline objects.

These OpenPage features provide a rich set of tools for the graphic designer to use. In particular they are able to work seamlessly between object graphics and pixel graphics. They can create artwork utilizing transparency and color blends.

Overall, the graphic designer can create significantly higher quality artwork than commonly found in the market today.

To achieve the performance required for photographic quality printing, CISRA has developed an Application Spe-

cific Integrated Circuit (ASIC) to accelerate critical aspects of the rendering pipeline.

Particular features of the chip include:

- JPEG image compression and decompression
- Image scaling and rotation
- Low level image and graphics pixel composition
- High speed color conversion
- High speed raster image input
- High speed raster image output
- Image processing convolutions for image blurring and edge enhancement.

Individual tasks are typically accelerated 100x over their software equivalent.

When applied to HyperPhoto, OpenPage is designed to print a typical letter size image of 1200 x 600 dpi in less than one minute.

## Template Model

In order to simplify customer interaction through the Graphical User Interface and keep the printout quality high, HyperPhoto makes extensive use of templates.

Templates are a combination of layout structure and artwork. For example, consider the printout in figure 5.

The template for this would contain two slots, one to position and size the user's source image and one text slot to format the customer's text. This is represented by the rectangles shown in figure 4.

In effect, each slot contains attributes that captures the design intent of a graphic designer.

This is highly desirable from the customer's point of view because it removes the need for the customer to be artistic. The customer only has to bring their photographs/negatives and optionally have thought of a message.

The resultant output is customized and personalized while still being artistically professional.

See figures 6 through 9 for some sample templates used by HyperPhoto.

## Service Items

The template structure described above is very general and is able to capture much of the context of a customer service application. This is very useful in the context of HyperPhoto and allows a broad range of services to be provided. A selection of these are described below:

### Enlargement

This is probably the most common service provided by DPE shops today. Images are printed out in a range of sizes up to 11.7" x 16.5".

### Additional Copies

This service item takes up to 8 of the customer's favorite images and combines them on a single sheet with a suitable background.

This service often utilizes the power of OpenPage by allowing image overlap and image tilt; a feature often avoided by other digital imaging systems because of the onerous demands on their RIP.

### Large Index

This type of service item has been made popular through the advent of APS.

HyperPhoto can place up to 42 index images on a single sheet.

### MultiPrint

MultiPrint lays out a collection of images at different sizes on a single sheet or creates a custom combination from a single image.

**Calendar**

Personalized calendars are easily created from the customer's own images.

**Photo Album**

This service makes extensive use of the power of templates. The customer's images are automatically laid out on a page by page basis in a Photo Album.

**Editing and Image processing**

No digital imaging system would be complete without a collection of image processing tools to renovate and enhance customer images. HyperPhoto supports the following:

- Dust and Scratch removal
- Red Eye removal
- Sharpen
- Crop
- Emboss
- Monochrome and Sepia.

These are all designed to be fast and easy to apply through a few simple mouse operations.

**The Canon Digital Imaging Network**

HyperPhoto has been designed to be an integral part of Canon's Digital Imaging Network (CanDINet).

The Digital Imaging Network provides a broad range of services that encourages users to share images between each other and provides a rich support service via DPE stores and Copy shops. CanDINet also provides a standard network interface to other Canon output devices.

There are five main services:

**Home Imaging Software**

Canon provides a home imaging software application called PictStage. This PC based application comes with many templates and clip art and allows the home user to easily create a broad range of personalized images, including greeting cards and albums.

PictStage is integrated with Image Bank and ArtGallery to receive templates, clip art and images. Using the Print Shop service, it can then print the home user's personalized design to any virtual DPE shop.

PictStage joins home PC users to CanDINet and facilitates home imaging.

PictStage utilizes OpenPage.

**Image Bank**

CanDINet provides an Image Bank service where users can store their digitized images in their own private space on the Internet. These images can be sent directly from the home computer or digitized at the local HyperPhoto store.

All images are password protected.

**ArtGallery**

CanDINet provides a free source of templates and Clip art for use with PictStage using a Drag and Drop interface. This Internet database has been open to the public since November 1997 and currently has approximately 6000 items available for use.

**PhotoGallery**

CanDINet provides a chargeable contents database of professional quality digital photographs that are available to the user. These are copyright protected using the latest WaterMark technology.

**Print Shop**

Canon provides a virtual print shop on the Internet where the user can send their customized PictStage templates or digital images. Print data is then sent to a local HyperPhoto store where it is printed and delivered to the customer.

**Conclusions**

Canon has been in existence for over sixty years, accumulating knowledge and understanding in photography, electronics, printing and digital imaging. HyperPhoto represents the culmination of that knowledge today.

As the world moves into digital photography, HyperPhoto has been developed to keep Canon at the forefront of that technology.



## Sample OpenPage Images

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Figure 2: An example OpenPage image featuring edge blends.

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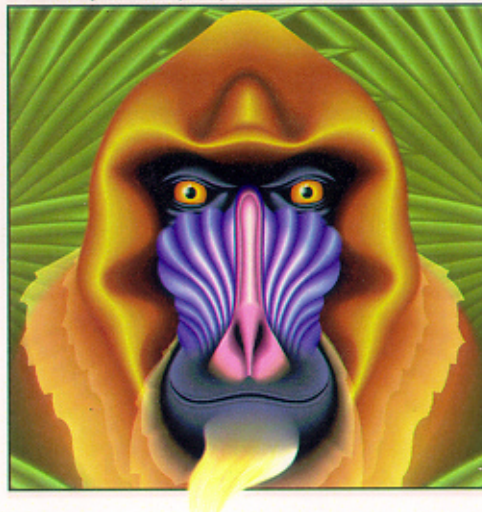


Figure 3: An OpenPage image composed solely of spline graphics.

## The Concept of Templates

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Figure 4: HyperPhoto Template Structure.

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Figure 5: A simple HyperPhoto printout.

These images were printed using a Canon CLC 800



## Sample HyperPhoto Templates

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Figure 6: A sample HyperPhoto album page.

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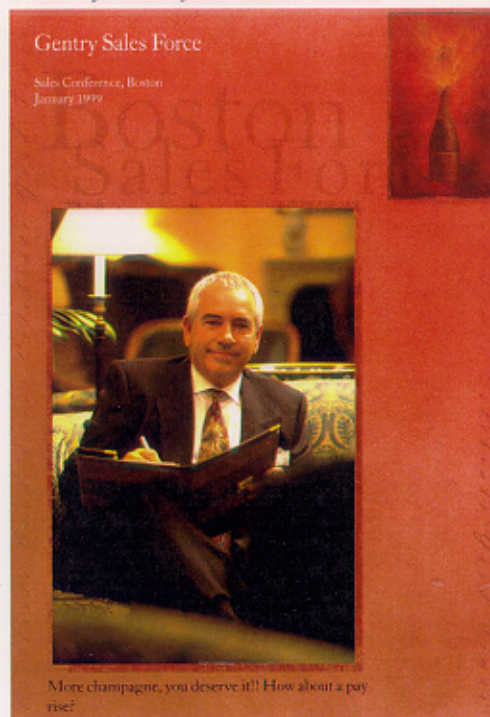


Figure 7: A sample HyperPhoto business oriented template.

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Figure 8: A sample HyperPhoto Poster.

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Figure 9: A sample HyperPhoto corporate template.