
What happens when you press PRINT?

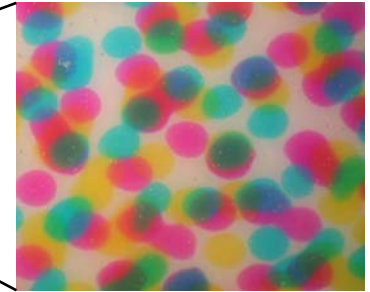
Dr Alan Hodgson ASIS FRPS

Contents

- Producing prints the digital way
- Inkjet printing
- The 3 decision groups of a printing system

Image Science in Pictures!

How is a digital print made?



So all we need do is...

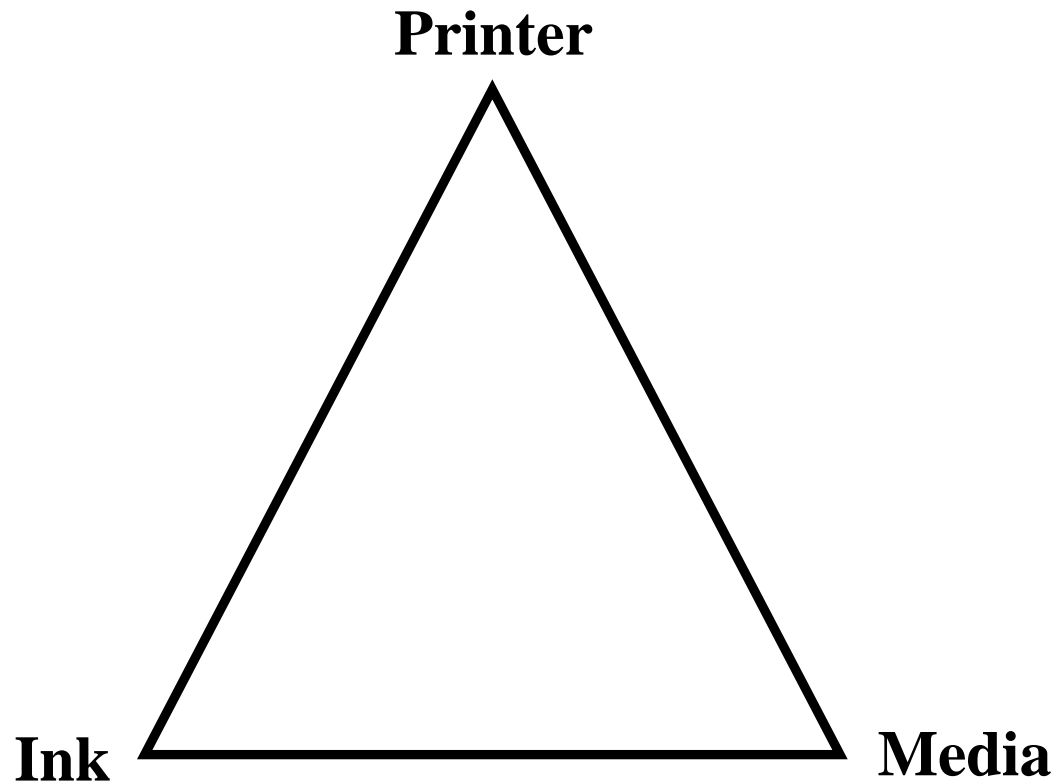
- Rip an image into many small dots
- Put them down onto “paper”

Not quite as easy as that!

- What dot density?
 - What size and colour?
 - Where do I put them?

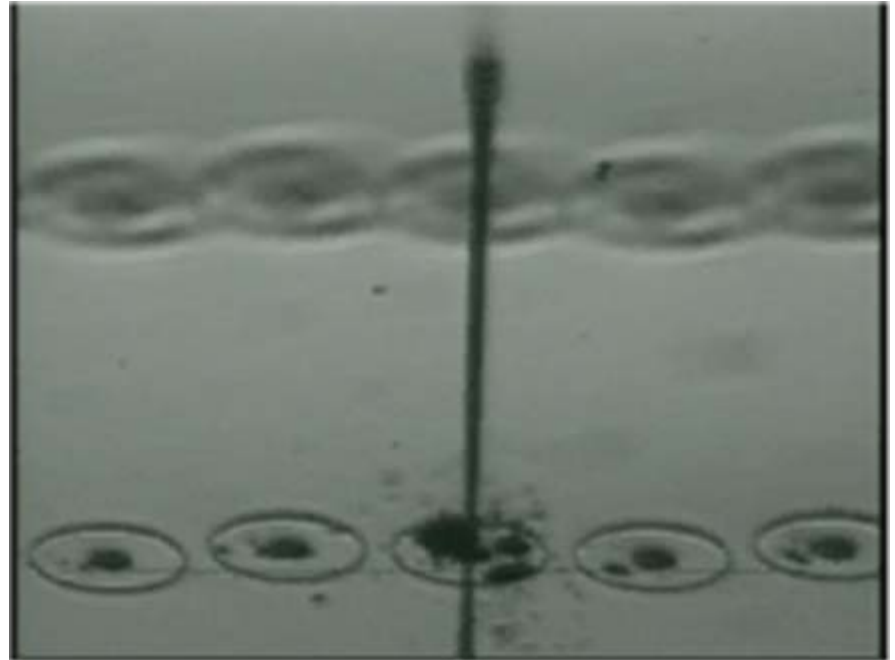
Quickly, easily, cheaply, reproducibly

The inkjet system

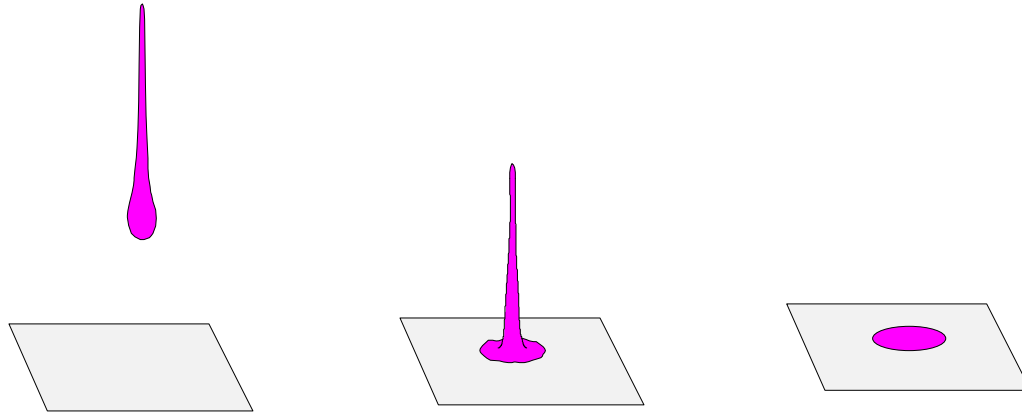


Drop size

- Dots per inch (dpi)
- Drop volume
 - Pico litres (pl)
 - 1pl = a 10 micron cube
- Inkjet typically delivers a few pl



The dot formation process



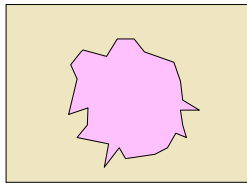
- Inertial spreading
- Wetting

- Absorption
- Evaporation

Dynamics of Printed Drops <http://pgs.iop.org>

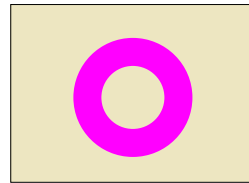
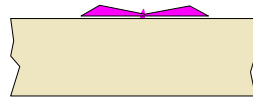
The effect of media type

Plain paper

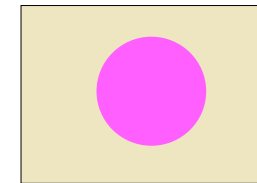
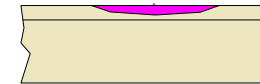


Non absorbent substrates

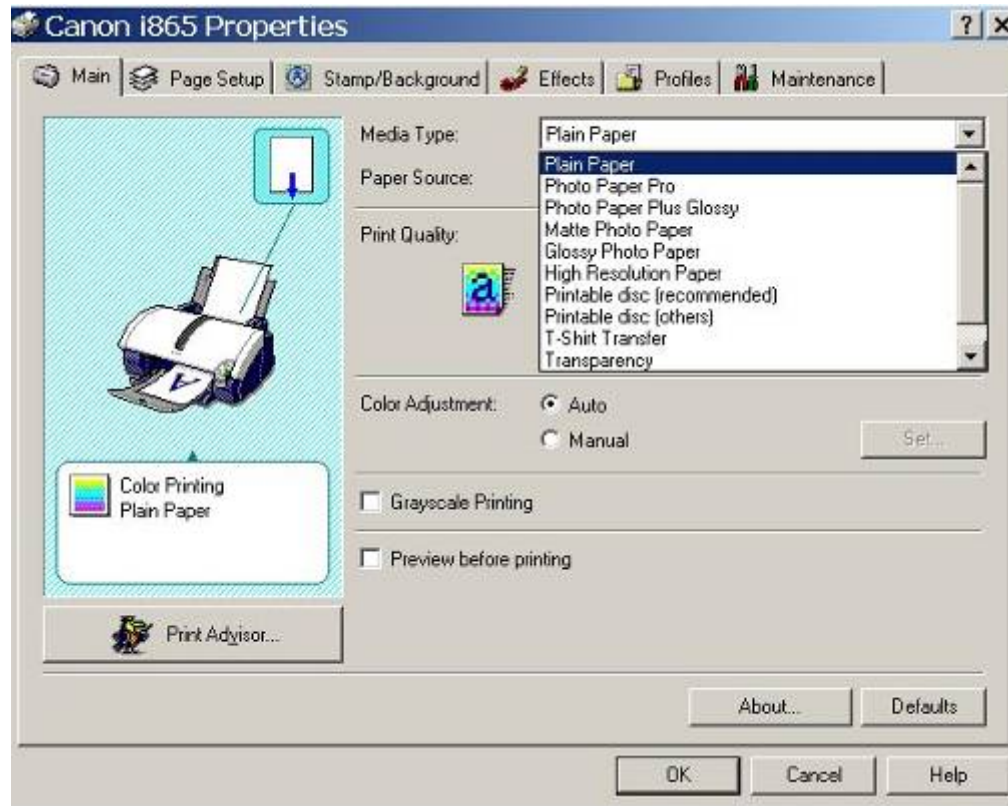
- Glass
- Plastic film



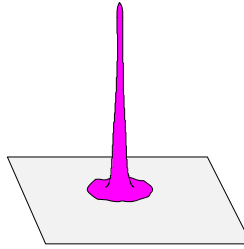
Coated media



Step 1. What am I printing on?

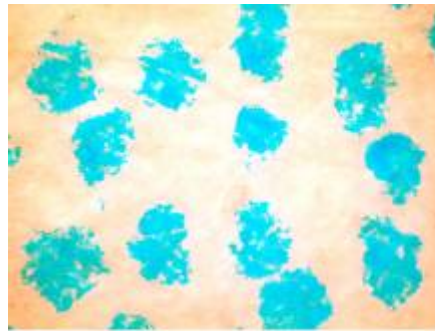


Ink / Media interaction



- dot size
- dot shape
- dot color
- dot optical density
- color gamut
- dry time
- strikethrough
- cockle
- color bleed
- edge sharpness
- fastness
- gloss

A real example



Plain paper



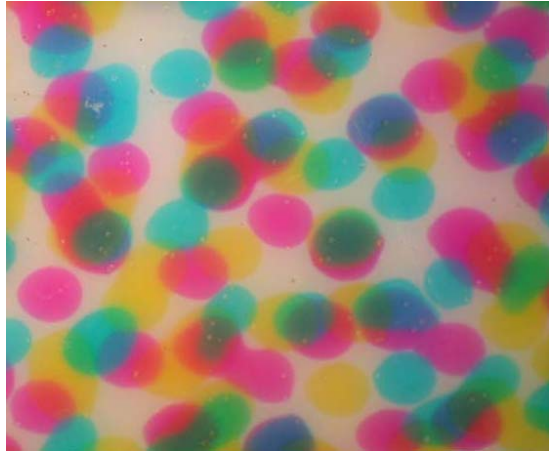
Cast coated



Polymer

↔
250 microns

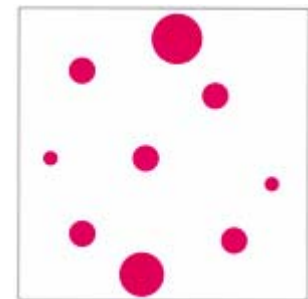
Step 2. What inks shall I print?



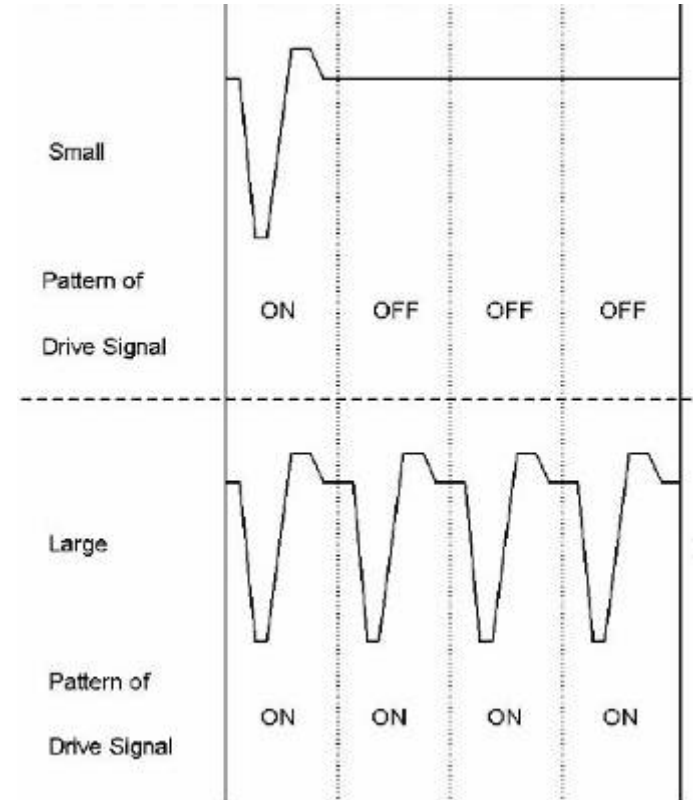
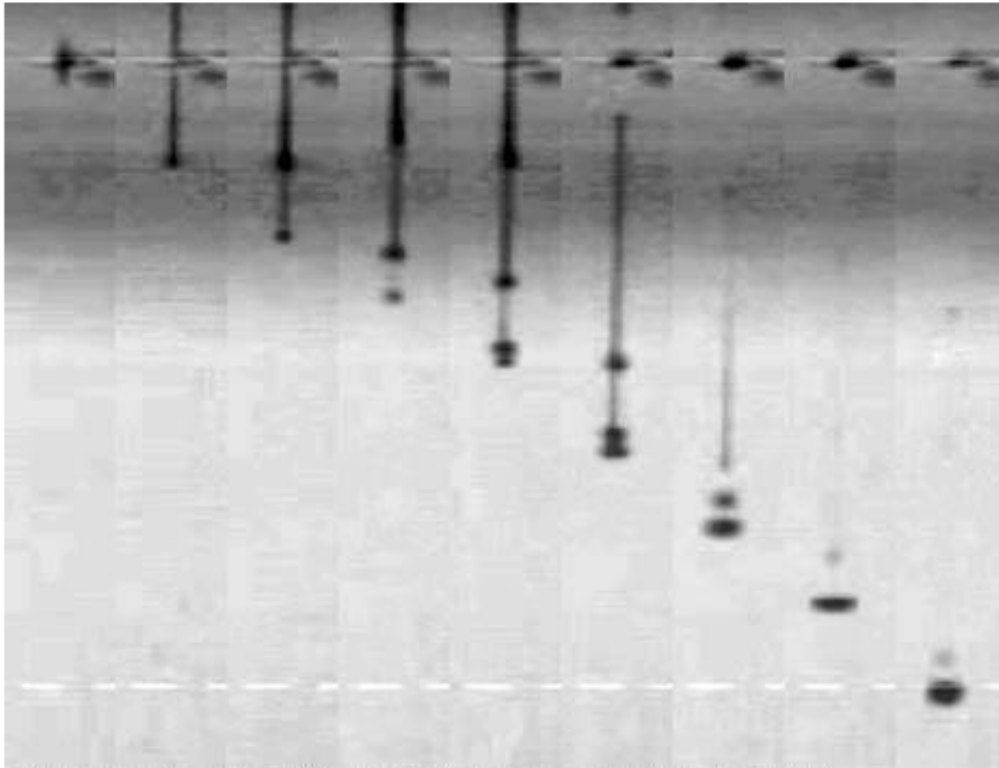
Grey Component Replacement

Great for graphics, but a bit coarse for photo

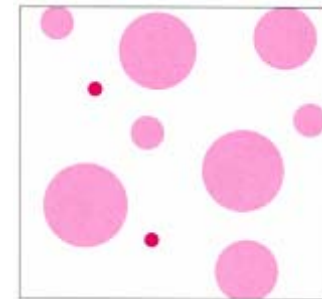
Variable drop size



One route to variable drop size



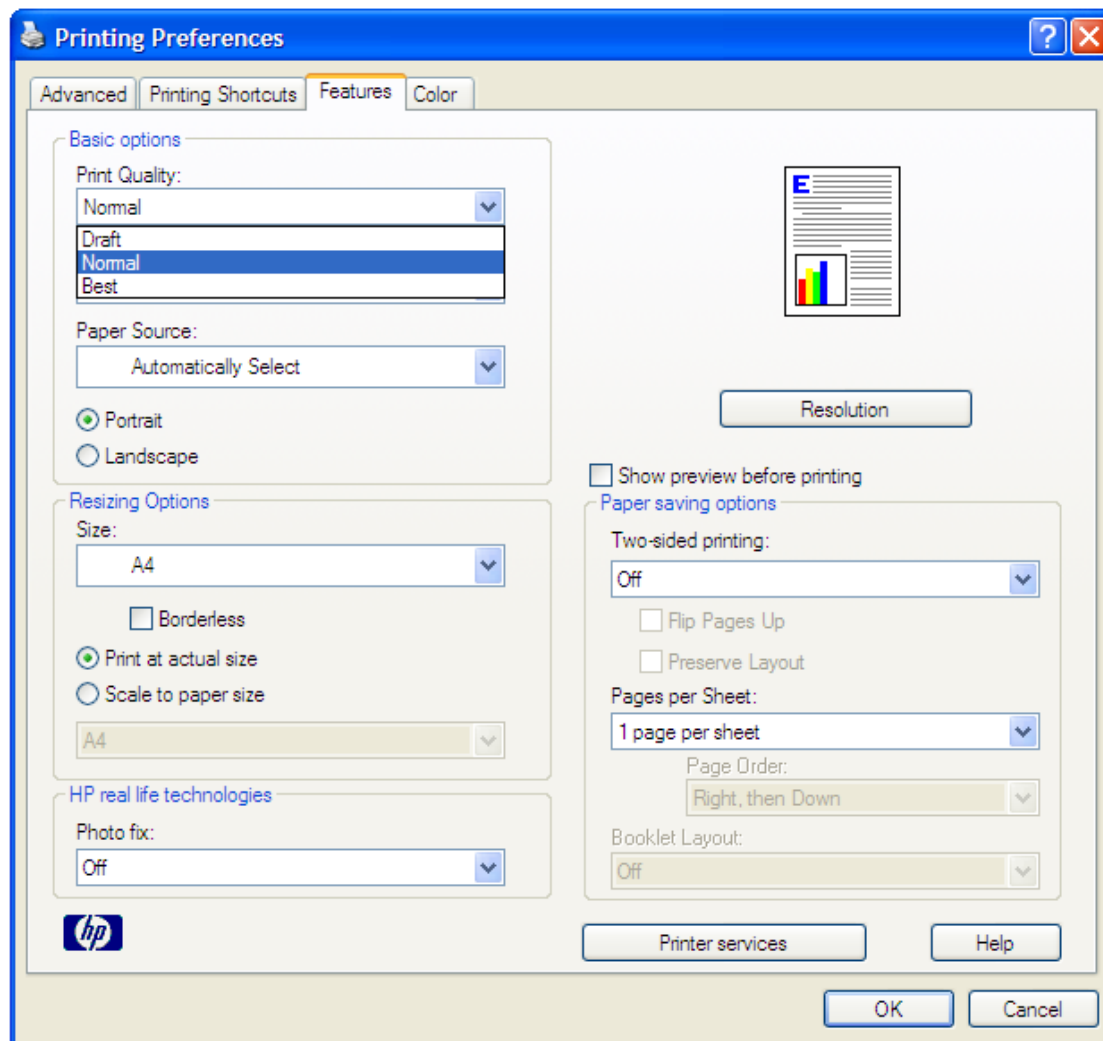
Add some “light” inks



4,6,8... colour options

- 4 colour CMYK
 - Cyan, magenta, yellow, black
- 6 colour. Usually CMYKLCm
 - Addition of “light” inks in cyan and magenta
 - This can also be 2 spot colours
- 8, 11, 12 etc. colour options
 - Various blacks, white, spot colours
 - Epson UltraChrome HDR
 - Pk, Mk, Lk, LLk, C, Vm, Y, Lc, VLm, Or, Gr

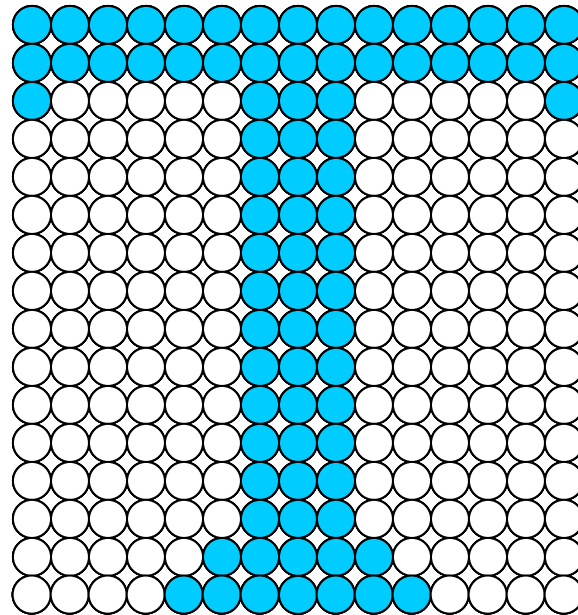
Step 3. How shall I print it?



Interlaced printing

2nd pass: First 8 nozzles print 50% of the bottom half of character while last 8 nozzles print the remaining 50% of top half of character

1st pass: First 8 nozzles print 50% of the top half of character



3rd pass: Last 8 nozzles print the remaining 50% of the bottom half of character

Circuitry on the cartridge

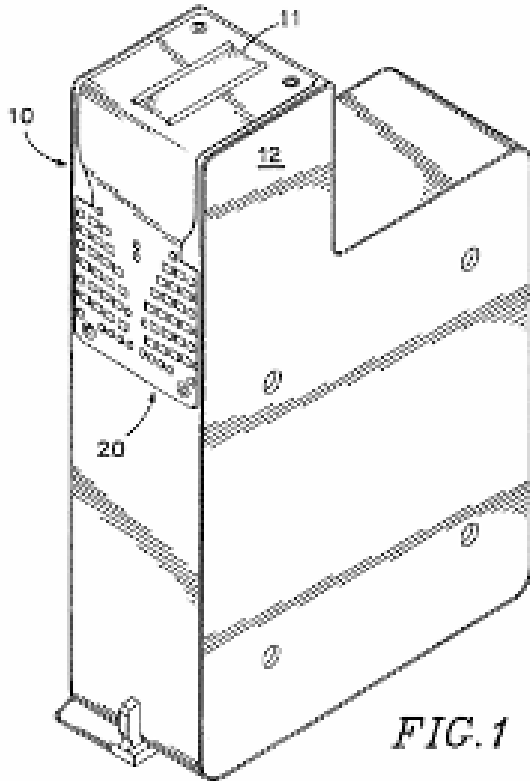
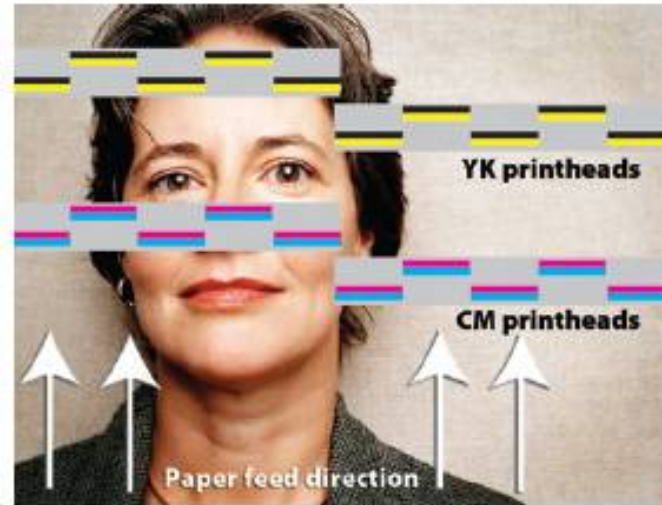


FIG. 1

1984	HP introduces the ThinkJet, a monochrome inkjet printer. 12 nozzles, 13 interconnect lines
1988	HP introduces the DeskJet, an inkjet printer for office applications. 50 nozzles, 56 interconnect lines

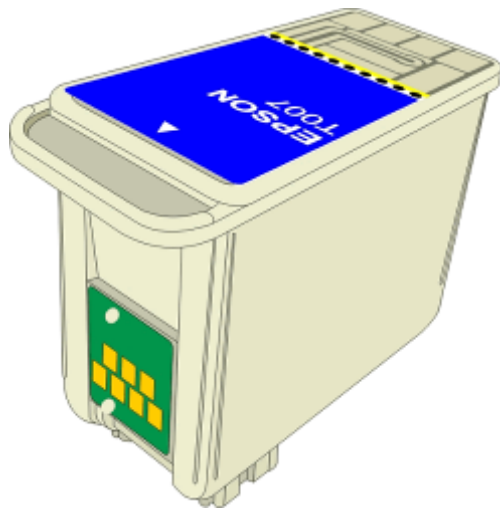
The HP Edgeline printhead



- 4.25" Edgeline printhead
- 5 x 2,112 = 10,560 nozzles
- 2 colours per head
- 1,200 dpi
- A size page printing

Control circuitry for the inkjet head

Circuitry on the cartridge



- New ink formulations
- How much ink is left
- Number of refills
- Brand protection

Conclusions

What happens when you press print?

- What are we printing on?
- What are we printing with?
- What drops, where, how big?

And it all still works!

Usually!

www.rps-isg.org and the blog “A Pixel of Imaging Science”