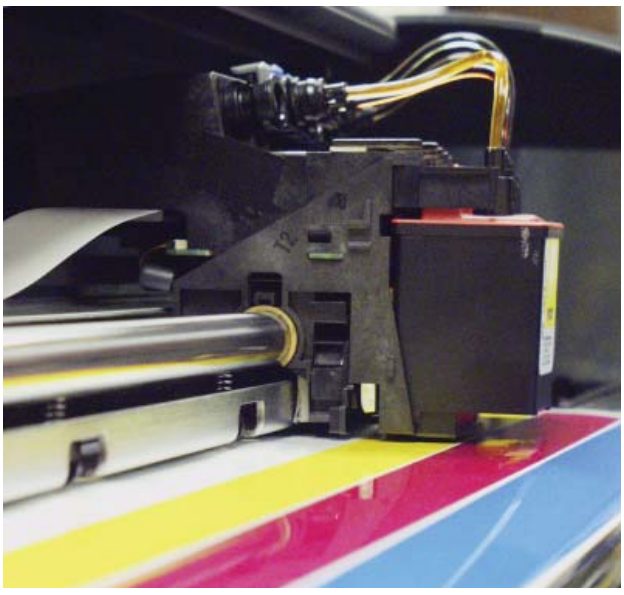
Upcoming Developments in Industrial Inkjet for Display Graphics



The wide-format graphics industry has been transformed through the emergence over the past dozen years of digital inkjet printing technology. Digital technologies have made possible the production of low-volume print jobs at prices that screen printing could not approach — but this has not so much eaten into the screen market as taken away its growth, according to researchers at ***Web Consulting***. Screen printing still rules where high volumes or quality requirements allow the cost of pre-press to be recovered in the total price. Digital printing for outdoor graphics has moved from aqueous to solvent-based inks, from paper to vinyl, and from 100 dpi to 360 dpi or more.

But the digital market is now starting to look almost mature, and new points of differentiation are emerging: UV inks for better durability without lamination, flatbed printers for direct printing onto rigid materials, and six-color ink sets. I am not talking about the use of light cyan and light magenta in addition to conventional CMYK inks — those are now commonplace. They do a useful service in improving tonal range, reducing contouring, but do not do anything to broaden the color gamut. I am referring to the use of additional colors, such as violet, orange and green, which actually make for a more color-accurate reproduction. See Figure 1, page 4.

As Figure 1 shows, the color spectrum that can be reproduced with a six-color ink set is significantly broader than with conventional CMYK alone, resulting in punchier graphics.

Up to six times more expensive than solvent inks, the cost of UV inkjet inks has been much-criticized. They are more expensive on a per-litre basis. But there are a lot of positives to UV-cured inks: the fact that the ink sits on the surface of the substrate instead of being absorbed means that less ink is used to achieve full coverage; the potential of avoiding the entire lamination process to ensure durability helps provide a cost advantage; the fact that — unlike solvent inks — UV inks cannot cure in the print head improves the print head life and reduces the need for maintenance; and the avoidance of VOC handling, which often has OSHA and EPA regulations. Taken together, these benefits have led many printers to conclude the use of UV makes a lot of sense.

Another development in machines at SGIA '06 (Las Vegas, September 26–29) that will drive quality expectations to even higher levels: the use of grayscale print heads. 'Grayscale' refers to the ability of an inkjet

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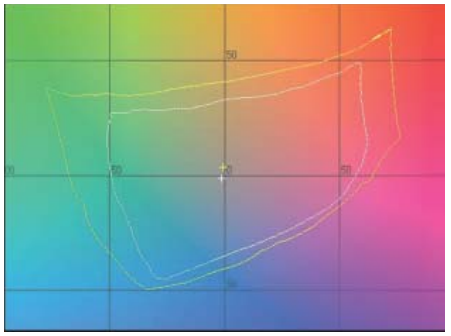
By Chris Lynn, VP Sales & Marketing, Xaar Americas



(Courtesy of Gerber Scientific)

Figure 1
White line = standard CMYK
Yellow line = CMYKVG

print head to deliver drops of ink of varying sizes. Conventional inkjet print heads are 'binary' — they either eject a drop of ink or they do not — and have a drop size typically between 20 and 80 picolitres. (A picolitre is 10^{-12} litres — a millionth of a millionth of a litre. A typical drop from an inkjet printer is, as a scientist recently described it, "a paintball the size of a baby gnat's spit.")

Grayscale heads eject even smaller drops — typically in the range of 3 to 8 picolitres — but they do so in groups at a much faster rate. A group of small drops joins together

Figure 2: Grayscale ink drops: small droplets join together to create a variable-sized drop

to make a larger single drop that lands on the substrate, which is a millimeter or so from the nozzle (Figure 2). The volume of the resulting larger drop is a volume multiple for each of the smaller drops, up to the number of 'gray levels' supported by the print head, i.e. 8, 16, 24, 32 or 40 picolitres for a six-level head, which has an 8 picolitre sub-drop volume. (Zero counts as one level.)

What's the point of this? Image quality. By varying the size of the dots made on the substrate, grayscale heads simulate a much higher resolution than their physical nozzle spacing and firing frequency allow. The apparent resolution is roughly equal to the real resolution multiplied by the square root of the number of gray levels. For example, Xaar's OmniDot 760GS8 print head has a native resolution of 360 dpi, and is capable of printing variable drops from 8 to 40 picolitres in size (i.e. six gray levels). So the apparent resolution of the head is 360 times the square root of six, which equals 882 dpi (360 x √6 = 882 dpi). This is approaching the quality of a photographic print made on a desktop photo-printer. It exceeds the 720-by-720-dpi mode on a typical wide-format printer, such as Epson's SP9800, while providing the ability to print several hundred square feet per hour. (The Epson prints only up to 40 square feet per hour in a bi-directional print mode. But it should be said that this represents a good value for a very modest investment.)

Do you need photo-quality on a billboard? Certainly not if the viewing distance is too great to tell the difference from conventional 100 to 200 dpi prints. But with a wide-format or grand-format machine that prints grayscale, you can offer clients the ability to print the same quality of image for all their display graphics — and do it without having to buy separate machines for smaller format, photo-quality work and wider format, high-productivity use. Alternatively, you can simply use the extra resolution to buy productivity: Scale back the resolution in the print direction to 180 dpi, knowing that the variable dot size will make it look like 440 dpi, and print at twice the speed.

Who makes grayscale print heads for solvent and UV inks, and where are they used? Xaar has its OmniDot range. Xaar has licensed its technology to Toshiba TEC, which offers two eight-level grayscale models, and to Konica-Minolta, which has two four-level grayscale models. Spectra also has discussed a grayscale head, but this has not appeared in the product line-up. Because the technology is relatively new, few printer manufacturers have gone public with grayscale-based machines. Agfa has collaborated on the development of the OmniDot 760 and will incorporate it in future equipment. The UPH head is Agfa's version of Xaar's OmniDot 760, with up to 16 gray levels. The same heads — 64 of them — are featured in Agfa's M-Press, a digital press that works with Thieme's 5000XL series screen printing modules to form a hybrid press. Other grayscale machines are likely to emerge at or around the time of the SGIA '06, including a narrow-web label printer as well as WFG machines.

The use of digital printing in the display graphics industry is well-established enough to encourage talk of market maturity. But the innovation rate in the field has not diminished. Continued developments in inks and substrates, print quality and machine productivity and reliability will drive digital printing deeper into analog territory. Like all disruptive technologies, digital printing will initially fail to meet all of the requirements that customers expect. Its adoption has not been and will not be painless. But the economics of inkjet printing ultimately will prove to be compelling, and the result will be better value for technology users and their customers.

Figure 3: OmniDot 760

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