A GREY AREA

Has inkjet really achieved offset quality? Not without a little help, says Martin Bailey, as he examines the complex interaction between components in an inkjet workflow and press

From about the middle of last year, the consensus seemed to be that inkjet had finally attained the same quality as offset lithography or flexography. You know how it is. You wander around a tradeshow and exhibitors are distributing wonderful colourful prints of German castles, big cats or piles of jewellery to show how their inkjet quality is superior to their competitors' press. People usually pull out their magnifiers and stare at the prints very closely.

What are they checking for? In most cases it seems that they know what makes a good offset or flexo print, and they're looking for that. However, inkjet is different from a conventional press and has distinctive strengths and weaknesses. If you're examining the detail in photographic images then modern inkjet will score very well, at least partly because most vendors usually use some form of dispersed screening (aka stochastic or FM), which can reproduce far more detail for the imaging resolution than a clustered or AM screen can. And when you add in greyscale heads that can place differing amounts of colorant in each location on the substrate, it gets even better.

THE SMALL PRINT

Now look at small text. Inkjet will often be printing at a lower resolution than offset, and much lower than high-quality flexo, and that has an impact on how well fine vector graphics can be reproduced. The ink technology used, in combination with how that ink reacts with the substrate also affects this area. Detail such as serifs in small text will look heavier (on UV or aqueous on coated stocks) or disappear completely (using aqueous inks on uncoated stocks).

In some print sectors, especially those with strong brand oversight or regulatory requirements, text is often converted to outlines in prepress, rather than using live fonts. But that will tend to make inkjet rendering even worse in comparison with conventional presses and increases the likelihood of very fine detail such as fine horizontal or vertical strokes disappearing completely, unless you're using a solution that's specifically tuned for common digital press resolutions.

MID-TONES

Another area in which inkjet has more challenges than offset or flexo is in printing relatively large and relatively flat regions of mid-tone tints. That's because inkjet has a tendency towards several different classes of non-uniformity in the output, which are typically split into microscopic and macroscopic: small and large artefacts.

Microscopic variations are often described as streaking, graininess, noise or mottling, and can occur for several reasons:

- drops coalescing on the surface
- heads being misaligned
- ejection timing not being quite right
- drops being disturbed by eddies in the air flow between the heads and the substrate
- ink shrinkage during drying or curing.

Macroscopic variations are the banding that you get along a single pass printer or across a multi-pass or scanning printer. The unevenness is caused by variations both within and between inkjet heads along the print bars in the press. This can be caused by:

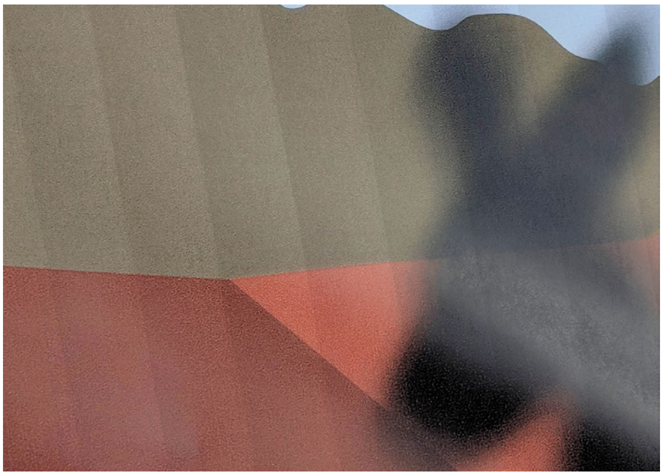
Banding problem shown on a section of a 'mega-light' wide format print before calibration in Global Graphics' PrintFlat software

- ink pressure and voltage changes across the head
- differences in manufacturing
- certain types of head/ink combinations wear with use; the more drops emitted, the more the head wears.

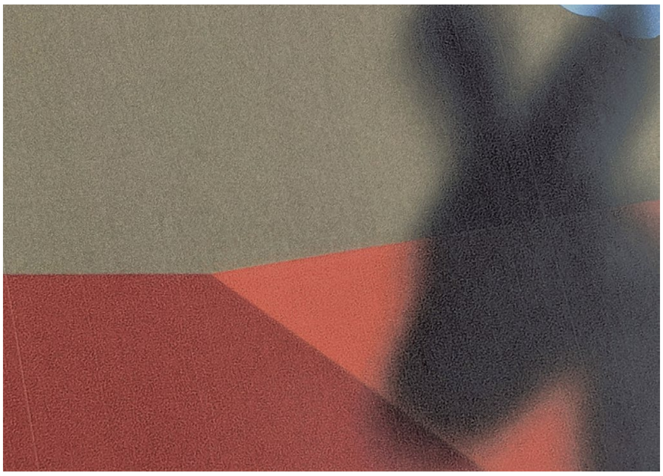
SOLVING THE PROBLEM

They are two very different things with very different causes. Most inkjet presses suffer from both to varying degrees. Where do you start to overcome them?

For microscopic non-uniformity, the first step is obviously for the press vendor to review their inkjet press design, considering ink



Close-up showing banding before calibration



Close-up of same section after calibration in PrintFlat is applied formulation with respect to the substrates to be used: throw distance; wave form; ejection timing; etc.

But at some point, any improvements to the physical design start becoming more and more expensive, and improvements to ink formulation begin to counteract other requirements, such as the need for open-time, drying efficiency, etc. It's often not possible to engineer all microscopic artefacts out of the system at a hardware, ink and electronics level. Yes, you could do more trouble-shooting but it's just going to cost too much up front, it's going to delay your time to market and make the press too expensive to build.

The good news is that microscopic artefacts are often amenable to correction in software by using a specifically designed halftone screen; something that counteracts the directionality of the inkjet system that leads to drop coalescence and therefore to streaking; or that manages the ink shrinkage during curing and drying that leads to mottling and graininess. Global Graphics Software's Advanced Inkjet Screens are an excellent example of this kind of solution.

The most common cause for macroscopic non-uniformity, banding, is simply variations between and within inkjet heads. Pretty much every head design has this issue to at least some extent, and historically press vendors have countered it by careful selection of which heads will be used together, combined with adjustment of voltages for each head, or for each region of each head.

Those techniques certainly improve matters but tend to make it slower and more expensive to build each new press and complicate any situation where heads must be replaced on an existing press.

They also usually don't go far enough in correcting the banding. When Global Graphics starts to work with a new inkjet press vendor we discover that their customers (the printing companies and converters) turn away jobs that they know will not be sellable if printed with inkjet presses because of banding.

"Customers are turning away jobs that they know will not sell when printed with inkjet presses because of banding"

Once again, the most cost-effective, efficient and complete solution can be applied in software. Using PrintFlat technology we adjust halftones for every individual nozzle as they are applied to compensate for the tonal changes that will occur when the output is jetted onto the substrate. This is proving effective on many applications from high-speed single pass décor to the scanning heads used by Ellerhold AG [producer of indoor and outdoor advertising] for its wide format 'Mega-Lights' installations.

Of course, another aspect of the complex interaction between components in an inkjet workflow and press is that the solution for non-uniformity must be fast enough so that the press can run at full speed. Fortunately, that's not a problem with well-designed and highly tuned software on modern computers.

IN CONCLUSION

For now, it's my contention that inkjet has still not quite achieved offset quality, although technologies such as those from Global Graphics Software are certainly helping inkjet vendors towards that goal. When exhibitors hand out posters of a 50% of flat grey from their exhibition booths, I will be persuaded that the day has arrived because that's a perfect way of demonstrating that inkjet really has overcome the problems of variations in uniformity. ■

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