



Photo courtesy DuPont

Proofing for **Four-colour** Process Screenprinting

New standards have led to improved accuracy.

By Mike Ruff

Proofing—which involves either test prints or images displayed on a calibrated monitor to represent prints that will be produced—has become more flexible and accurate today than ever, thanks to valuable advances in technology that have enabled high quality at low cost. These advances include device link profiling and the International Digital Enterprise Alliance's (IDEAlliance's) G7 methodology, a standard developed by the not-for-profit publishing organization's General Requirements and Applications for Commercial Offset Lithography (GRACOL) Committee to allow proof-to-press and press-to-press calibration across different methods of printing.

A variety of types of systems have been used in the past or are being used today in the screenprinting field, including press proofs, analogue film-produced proofs, digital proofs and soft proofs.

Press proofs

Before the off-press proof was developed, the only way an industry professional could predict what a final print would look like was to image a set of film, screens or plates and print away. This output was a press proof.

In comparison to today, back when this was a normal part of the printing workflow, labour represented a much lower percentage of the cost of a job, the equipment did not cost millions of dollars and there were not as many companies competing for the same job. As such, press proofs served as an affordable and effective way to control colour.

If they could be printed and the customer liked them, there was a good possibility they could be repeated. If the customer wanted to make a change, it was a major issue, but the costs of reprinting were still lower in those days.

Indeed, all print providers producing four-colour process output were required to create press proofs—but the days of a level playing field would not last forever. Eventually, the off-press proof would set progressive four-colour process print shops apart from their competitors.

While there are still some screenprinting shops that create press proofs today, this simply is no longer feasible and they are either overpricing



Images courtesy Nazdar Consulting Services

Film-based proofing was pioneered in the early 1970s with the development of toner-based off-press proofs.

their work or going out of business, neither of which is a desirable situation. Eventually, four-colour process screenprinting will just be a faded memory for these companies.

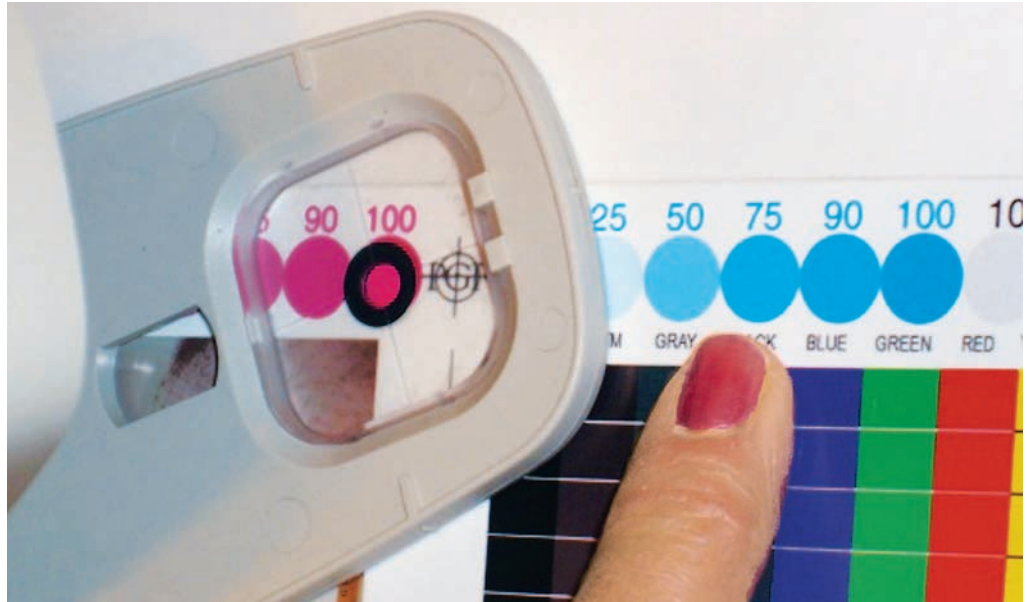
Off-press proofs are more accurate, feasible and affordable—and unavoidable when dealing with modern print buyers. The three types of these are analogue, digital and soft proofs.

Analogue proofs

In the early 1970s, film-based proofs—rather than print proofs—became a reality with



Calibration and colour measurement instruments have evolved for digital proofing systems, enabling greater accuracy.



Some early mistrust of the accuracy of digitally produced proofs was due to a poor understanding of calibration and colour measurement instruments.

Off-press proofs helped set progressive print shops apart from their competitors.

the development of DuPont's Cromalin, a toner-based off-press proof. It was created by exposing a carrier sheet to ultraviolet (UV) light, applying a toner within the cyan, magenta, yellow and key/black (CMYK) colour model and then laminating to a white proofing-paper substrate.

By using dots on film, data variations were represented through measurable, physical qualities—*i.e.* in analogue form. The Cromalin simulated the dot gain of an offset press very closely, with even solid CMYK colours close to offset-produced solids; but the analogue proof required the printing professional to understand both dot gain and ink density before he/she could then produce the same colour on the press. Thus, the level of accuracy compared to the proof depended on the professional's own level of skill and knowledge.

This was breaking new ground for printing companies. Where press proofs had only required 'repeatability,' off-press proofs required repeatability, skill and knowledge. As a result, consulting advanced to serve the industry.

By the 1980s, film-based analogue proofs had largely displaced press proofs. Other manufacturers besides DuPont advanced

the technology over time, such that matching proof to press became even more accurate.

The bar for quality was beginning to be raised. Red was not just red any more—it needed to be the right red. Fleshtones needed to be specific, not just generically 'white' or 'black.' Analogue proofing and highly skilled consultants helped meet the growing challenge and the industry continued to prosper.

Digital proofs

In the 1990s, digital proofs debuted. As digital technology represents physical data variations by means of discrete signals interpreted as numbers, no longer did a film exist to create the image. Instead, the image on the proof—or more specifically, the values that made up the image—were created electronically.

Eliminating the need to make proofs from film was a significant advance for the industry. Proprietary digital systems like Eastman Kodak's Iris and Approval and 3M's Rainbow helped reduce labour and material costs and were very fast compared to their analogue proofing predecessors.

Initially, however, many printing professionals did not trust the colour accuracy. This mistrust was somewhat

due to a poor understanding of calibration and colour measurement instruments, but also because those who sold and set up the earliest digital proofing systems were not always qualified to teach their customers how to use them.

Early ignorance cost the industry a few years in making the move to digital technology. Had the manufacturers recognized the quality and accuracy of resulting prints was their responsibility, they could have sold many more millions of dollars' worth of equipment.

Indeed, the sheer expense of early digital proofing systems should have supported better training at the time of setup, given they could cost from \$70,000 to more than \$100,000.

The prices needed to come down and support needed to go up before printing professionals would feel confident about switching to digital technology.

As they gained experience, colour accuracy improved. High-priced and proprietary digital proofing became accepted as an off-press predictor of on-press results. There were a few holdouts, but most progressive companies moved on.

By 2000, the proper application of colour-managed proofing in line with International Color Consortium (ICC) standards helped make lower-cost inkjet printers from manufacturers like Epson and HP viable for the industry. These systems were not only less expensive, but also faster than early digital proofers.

At first, inkjet output for proofs received a lot of well-deserved criticism. Some vendors were overzealous and colour management was not always as accurate as it needed to be. Again, in the face of industry ignorance, consulting advanced further.

Inkjet proofing survived because of its tremendous cost savings, speed and flexibility. Improvement of printers, substrates and colour management techniques continued to support the growth of the technology.

Advances in both direct-to-screen and direct-to-plate systems also responded to the need for inexpensive proofing devices that would not require film or, for that matter, an extra \$100,000 investment.

As a result, digital inkjet technology soon dominated the proofing market. Today, there are very few analogue proofs made any more.

Digital proofs can now simulate line counts, angles and even International Commission on Illumination (CIE) L*, a*, b* colour space values of solids and overprints. They are much more flexible and, when well-managed, more accurate than their analogue predecessors.

Soft proofs

Soft proofing is the future, as it simply involves an image on a monitor that accurately represents what will be produced on a printing press.



The not-for-profit International Digital Enterprise Alliance (IDEAlliance) developed both General Requirements and Applications for Commercial Offset Lithography (GRACOL) and Specifications for Web Offset Publications (SWOP) to improve press-to-proof, proof-to-press and press-to-press calibration.



Photos courtesy DuPont

Drop-on-demand (DoD) inkjet technology has been configured for use with roll-fed substrates intended specifically for proofing.

With improvements in monitor accuracy and monitor-based proofing software, soft proofing first became viable around 2002 to 2003. Sophisticated colour verification technology was developed, tested and proven accurate to ensure client confidence.

When a monitor at the press and another at a customer's office thousands of miles away can be verified as simultaneously displaying exactly the same output as each other, there should be no need for hard proofs any more. Nevertheless, there were many holdouts.

Indeed, industry buy-in is still not total today—nor might it ever be. All of the right reasons to use soft proofing are in place, however, and clients are demanding faster turnaround. There is generally no time to 'send a proof' in the traditional sense.

Clients want to make corrections and change colours in real time without having to pay for proofs or travel to the

printing facility. Hence, progressive print shops that have already embraced this technology are becoming very popular with print buyers.

Proof-to-press accuracy

IDEAlliance—which develops and maintains uniform specifications and tolerances to ensure the consistent quality of publications and other printed materials—introduced G7 in 2007, defining grey balance in colorimetric terms. Previously, all colour standards and specifications had been specified in terms of Tone Value Increase or dot gain and solid ink density.

G7 set in place a new methodology developed by IDEAlliance to modernize and improve the latest versions of both GRACOL and its Specifications for Web Offset Publications (SWOP). This has made a significant difference in press-to-proof matching in both the screenprinting and digital printing sectors, providing the tools for professionals to match both technologies to one proof.

The main purpose of G7 is to simplify the calibration of any printing device—such as a pre-press proofing system or a printing press—to International Organization for Standardization (ISO) 12647-2, *Graphic Technology: Process Control for the Production of Half-tone Colour Separations, Proof and Production Prints – Part 2: Offset Lithographic Processes*. (While this standard is specified for lithographic printing, G7 can actually be applied to any type of printing that uses a CMYK colour model, regardless of the inks or the technology that places them on the substrate.)

So, while G7 assumes the use of standard inks for which precise L*, a*, b* values are defined in ISO 12647-2, even if a device uses non-ISO inks of different colours, G7 calibration will result in the same 'natural' grey scale appearance as with all other devices. And indeed, IDEAlliance has specified G7 as a constant component of all future print specifications and offered it openly for adoption by all standards associations for all types of imaging and media, worldwide. The Specialty Graphic Imaging Organization (SGIA) has also organized a work group for G7 screenprinting.

The primary advantage of G7 is it results in a constant appearance, in terms of grey



The development of inkjet-based proofing brought cost savings, speed and flexibility.

balance and neutral density, without the need for additional colour management. It is the first calibration methodology to offer cross-media greyscale consistency, allowing files to be more easily and safely repurposed for screenprinting and digital printing alike.

Certification of monitor-based proofing

Another advance occurred in soft proofing in April 2008, when IDEAlliance developed SWOP-certified monitor-based proofs that could closely simulate SWOP-certified analogue or digital proofs.

At that time, IDEAlliance announced the first monitor-based proofing systems to be certified under its new 'to the numbers' program, which was based on ISO 12646, *Graphic Technology: Displays for Colour Proofing – Characteristics and Viewing Conditions*. Some 30 monitor proofing systems had undergone the new certification procedures between December 2007 and March 2008. The procedures were intentionally designed to resemble those for hard-copy proofing system certification, wherever technically possible.

Yesterday, today and tomorrow

Press proofing, analogue proofing, and expensive proprietary digital proofing systems are on their way out. Inkjet proofing with high-quality raster image processors (RIPs) has become very accurate and flexible, responding to the desire some print buyers still have for a hard proof to compare against prints—but soft proofing, using colour management and software, represents the future of the industry.

Further improvements will be needed. Soft proofing must get past current obstacles, including high prices and workflows that are difficult for print shops to implement. Once these goals are met, the need for hard proofs in most printing facilities will be removed.

Mike Ruff is chief technology officer (CTO) for Nazdar Consulting Services, which serves the screenprinting and digital printing sectors and was reportedly the first consulting organization to use G7 in proofing screenprinting and matching proofs to press. For more information, contact him via e-mail at mruff@nazdar.com.