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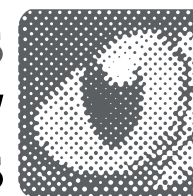
Digital Printing & Digital Imaging Presses

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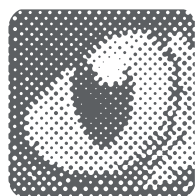
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Digital Dots Technology Guides

The Guide to Digital Printing & Digital Imaging Presses

Second Edition

Digital Dots
Technology
Guides

The Digital Dots Technology Guides

This publication is part of a series of independent technology guides for publishers, graphic arts professionals, printers and print buyers. Technology Guide titles provide straightforward explanations of how technology works, what it's for and considerations for investment.

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About Digital Dots

Digital Dots is an independent graphic arts research and content development company established in 1999. The company is a collection of like-minded graphic arts consultants, pixies and professional journalists specialising in digital print production and publishing technologies. Digital Dots provides exclusive market research and content based on its own testing and evaluation services for prepress and publishing applications. It also publishes Spindrift, the industry's only independent journal for graphic arts news, analysis and comment.

With great thanks to the supporters of the Technology Guides:

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Introduction

Welcome to the Technology Guide to Digital Printing & Direct Imaging Presses

It's barely ten years old, but digital colour printing has suddenly come of age. Product development is shooting forward with both mature printing technologies and innovative new devices coming out. The printers and prepress houses who have invested in digital printing are seeing excellent results, despite the fact that many of them are serving new and emerging markets. Digital colour print has provided many companies, large and small with new business opportunities, as well as helping to expand production capacity and service offerings.

The following pages cover everything you need to know about digital colour printing technology, including variable data printing devices and direct imaging presses. We explain how the basic digital printing technologies work, along with the main issues that potential buyers need to consider as part of their investment planning into digital colour printing. We have also included an extensive overview of the suppliers in the top end of the market and their latest products and how their customers use them.

This guide does not cover the low end of the market, but focuses instead on technologies specifically designed at the professional graphic arts industry. We include direct imaging presses, as many companies are looking into this technology to provide them with a viable short run alternative to a conventional press, digital or conventional. These presses use offset printing techniques, imaging printing plates directly in the press.

Successful investment is about choosing the right technology for your business, but the choice is also about getting the best service and support deal for your company. Cost of ownership, investment protection, adaptability for changing production needs, all these need consideration alongside the technology. The Digital Dots Technology Guide to Digital Printing gives you the background for understanding how to turn the technological complexities into sane and relevant information. We hope you find this publication useful and welcome your feedback.

Digital Printing: a Never Ending Story

The names and the faces are well known. The possibilities and the potentials are equally well aired. We all know that digital printing is important, and we've heard too often that it will replace conventional print. Eventually. One day. We keep hearing this yet the big money is still spent on mammoth beasts from the likes of Heidelberg and MAN Roland. The conventional press is supposedly soon extinct, even though it images tens of thousands of pages per hour, with dazzlingly efficient quality that's constantly improving. Analogue printing does not stand still and in its ability to mass-produce gorgeous images of our world and our ideas, it continues to defy the laws of physics. But how long will conventional presses maintain their tremendous lead? How long will it take before digital printing really does take over?

> **1977:**
> *The industry's first laser printer, the Xerox 9700, is introduced.*
>
> **1982:**
> *The first microprocessor controlled and Ethernet networked photocopier is introduced.*

Actually those are not the right questions, even though they are the questions most often asked in print media news headlines, and by grubby-fingered conference organisers looking to snaz up some redundant seminar. The real question is not when, but where, how and why digital print will take over. For this is not about technology, it's about business and the contribution print makes to socio-economic development. It's about people and their media habits.

Conventional Presses Enduring

Newspaper publishers recognise this, investing into new press technology accordingly. The UK's Johnson Press, a large regional newspaper group, is installing a second triple width press as part of an investment that tops £110 million. That wodge of readies would buy over 100 digital presses. Also in the UK the Daily Mail & General Trust is spending over £100 million on full colour printing, having already ploughed some £165 million into colour facilities for its national and regional titles. The investment has already yielded a return, with a 6.5% increase in ad revenues as a result of enhanced colour capabilities. It pales in comparison to News International's £600 million spend for new presses.

The story's pretty much the same with magazine and book printing, so either the executives behind these investments are a few faces short of a font, or they understand something the digital angels overlook. Digital printing isn't just a straight swap, replacing one process with another, and for the majority of business applications conventional technologies are still preferable. Digital printing's future lies not in its capacity to

replace offset, but in its ability to complement it and serve new process needs more effectively.

It's About The Business

Digital printing is reshaping conventional expectations for print's purpose; a business's expectations for print's performance drive the rate of adoption of digital printing. It's very hard to get people to think beyond their experience, but it is happening. Take direct mail for example. Traditional direct mail response rates are around 2%, with less more common than not. Generally speaking the bigger the run and mailing, the smaller the return. In contrast digital print response rates are estimated at anywhere between 20 to 70% (depending on whose figures you use) and the run lengths, which tend to average between five and twenty thousand, have less of a negative influence on return rates. Impressive response rates however have much to do with the database driving output, which is matching variable content in each printed piece, to the specific interests of each target reader. Digital printing technology means that direct mail applications no longer need to be a high cost, long run, hit and miss marketing black hole. Variable data demands tight database management and thus is far more effective.

Direct mail and transactional print share some fundamental features in common, most significantly their common dependency on data variability, which is the primary differentiating factor between analogue and digital print. These applications are fundamentally different in that a business depending on transactional print will fail immediately without rock solid variable data output, which is why the likes of IBM and Océ have done so well for so long with their high speed, continuous feed engines and dedicated transactional print front ends. However

variable data management capabilities, colour and speed enhancements, create space for other applications. This migration to variable data output, and its rate, is shaping the growth

> There is no doubt that the digital print revolution is not a mere revamp of what's already practised. Many of the factors driving new print applications also drive improved production and use of conventional print, which is one reason why print volumes have fallen: we produce less, we use it more effectively and we are fussier about what and how much we produce, at what price and for whom.

of digital printing markets. Xerox is installing a herd of 24 iGens at the Sumitomo Mitsui Card Co. Ltd., one of Japan's leading credit card companies. The company's printing millions of personalised, colour credit card

statements on demand, a project that helps bring Xerox's worldwide total of iGens installed to more than 800 units. It is through initiatives such as this, that we expect to see direct mail and transactional applications starting to cross over as businesses look at improving capital equipment utilisation and gain experience with the technology.

New Applications or Old Ones Revamped?

There is no doubt that the digital print revolution is not a mere revamp of what's already practised. Many of the factors driving new print applications also drive improved production and use of conventional print, which is one reason why print volumes have fallen: we produce less, we use it more effectively and we are fussier about what and how much we produce, at what price and for whom. For example, better database management techniques improve direct mail response rates, whether it's variable content print or not, providing a tighter match between print product and market.

Preproduction efficiencies mean faster time to press and greater frequency of print runs. The effect is to erode run lengths and costs, but neither undermine the value of print or its effectiveness and as mass markets continue to respond to print, the arguments for conventional presses are overwhelming. It's about economies of scale, but it's also about the speed with which applications migrate to variable output. In the UK HP Indigo is installing a 3050 at Prime Litho, traditionally an offset printer. The UK government has commissioned this company to print a range of personalised tax information cards for distribution to the UK's registered accountants. The material is customised for each company, with a front cover that matches

each accounting firm's corporate identity. The bulk of new print applications are either variable data printing such as this, or very short run work.

How Big is Big?	
Canon Employees	93,620
Xerox Employees	58,100
Fujifilm Employees	75,600
Kodak Employees	54,800

Direct Imaging

The contribution of direct imaging presses here is muddy, since this technology is considered neither fish nor fowl. Direct imaging presses combine a platesetter and printing press, so many people question their worth, particularly with a four unit press. After all, why should the press stand idle while you wait for plates to image? Isn't it better to buy one platesetter that can feed many presses? This isn't an issue if the press isn't constantly running at full capacity. We've yet to be convinced that direct imaging presses have a long future, but they will indeed be cost effective for many businesses. For example, companies who don't want to bother with platesetting, who want convenience plus quality and speed, or who have space and investment constraints should certainly consider these machines.

Traditional presses, DI or not, have a lot going for them. This is why companies like specialist Welsh language book publisher Gomer Book Manufacturing prefer to spend £2 million with Heidelberg to print 200 book titles a year on a four-colour B1 Speedmaster, rather than a digital press provider. Digital print complements offset, meeting new purposes and print media applications. Although digital

printing works for the old applications as well, its future is in applications we are still inventing and in how variable data applications evolve longer term. This is where everyone is looking and it's why Screen and Agfa have lately joined the party.

Conclusion

The major players are discretely drooling in anticipation of the prospect of change in the socio-economic landscape and the role of print within it. Credit card bills with customised advertising messages are only the beginning. Compliance laws from every corner of industry are stalking all businesses, compelling them to fully and accurately document virtually everything they do. From land usage, to customer service conversations, to proof of identity for financial transactions, through to account activity tracking, it's all slowly simmering digital press market opportunities and steadily warming them to a rolling boil. And this is where the likes of Canon, HP, Kodak, Agfa and Xerox have set their sights.

Background & Printing Technologies

Since the first digital colour presses were shown in 1993, the world has changed. The digitisation of printing has happened in parallel with the digitisation of most other media technologies and delivery methods; cameras, TV, radio, etc. And of course we now use a medium that was but a babe in 1993 – the Internet. Digital printing seemed fairly revolutionary when it first appeared and many a printer was highly sceptical. Today, it's a natural part of a media landscape where personalised messages, on demand information and choice is where we are going. Digital printing technologies are in the late stages of their second generation: mature, secure, stable and yielding very high quality print. The industry has confidence in what the presses can do and although electrophotographic presses were the sole players in the commercial print sector only a few years ago, Kodak, Screen and Agfa have thrown their weight behind inkjet. It is the technology to watch.

In the Beginning

When the first digital presses came onto the market, printers were not really ready for them. The printing fraternity was getting used to the idea of customers supplying them with digital originals and, on top of that, had just been told it was now possible to let digitised material flow straight onto plates. When Indigo and Xeikon launched their first digital presses in the mid-1990s, they met with scepticism from a printing industry still struggling to embrace the desktop shock.

Many people could see the advantages of being able to print fully variable, full colour information. Press suppliers were rightly very enthusiastic – they had developed a completely new type of press which would revolutionise what the printing industry could offer: unique copies. The suppliers put a lot of effort into educating the printer, some of whom did the same for their customers. At the same time, a new group got into printing – many prepress companies invested in digital print capacity, already having the capability of handling digital material. But despite all the early effort, the breakthrough just didn't come.

The pioneering Xeikon and Indigo invested enormous amounts to develop technologies they firmly believed were the future, choosing two different strategies to gain market share. Xeikon signed OEM agreements with several other printer, press and prepress suppliers. Agfa, Xerox and IBM developed and sold proprietary front end systems for the Xeikon engines. Following reshuffling in the spring of 2000, all rights reverted to Xeikon. Indigo preferred to reap the fruits of its digital press development alone and has never OEM'ed its technology to others.

During the 1990s Xeikon and Indigo remained the only suppliers of full colour digital print engines. The big turning point was Drupa 2000, when several others, notably Heidelberg and Xerox got onboard. They saw a potentially huge market, which they could not afford to ignore. Business changes have since seen Heidelberg exit both digital print and the direct imaging press market in which it was a major player.

Press Categories

Electrophotography

Putting subjective print quality aside and looking instead at issues such as speed, cost and capacity, there are today two main categories of commercial electrophotographic press. The top-end devices output around 60 to 110+ A4 pages a minute; this group includes second and third generation machines, conceptual descendants of the first digital colour presses launched a decade ago. These

> **Digital printing technologies are in the late stages of their second generation: mature, secure, stable and yielding very high quality print. The industry has confidence in what the presses can do.**

presses require a certain level of operator skill and involvement, and are definitely not designed for office printing. They are flexible as far as substrates, formats, workflow and inline finishing are concerned. Monthly capacities are generally from 500,000 to 1.5 million pages. The main suppliers are Xerox, Kodak, HP Indigo, Xeikon and Canon. Many cost between €200,000 and €500,000 and some, like the Xerox Docucolor iGen3, and the HP Indigo ws3200 a couple of hundred thousand euros more.

A new market segment emerged a couple of years ago, for users who want to get into digital colour printing, but at lower cost. At entry level there are several devices producing about 30 pages a minute from suppliers such as Canon, Xerox, Océ, Toshiba, Konica Minolta and Ricoh. These machines are not built to run 24/7, generally print on substrates up to about 250 gsm and have limited finishing options. Prices start at around €30,000. These types of devices come out of the office copier market and are sometimes referred to as "green button" engines: they require little operator involvement beyond pushing the print button, but they offer less functionality than their top end siblings.

Most digital colour presses use some sort of electrophotographic means to generate the page image. There are some variations in how electrophotography works but the different technologies operate along common principles. A drum covered with a photo-electrical conductor is charged and the conducting material then exposed to varying intensities of light from a laser or LED. Where the light hits the drum the surface material loses its charge and acts as a carrier for the image. Charged toner or ink is then attracted to the image areas of the drum. Océ has its own technology, Océ Direct Imaging, which uses magnetism to generate the image and removes unwanted toner from the drum.

Different presses use different methods to transfer the toner/ink to the paper or other substrate. Often there is an intermediate medium, sometimes referred to as a blanket. This is true in for example the Xerox Docucolor 2000 series, which has what Xerox calls a Digital Blanket. In the iGen3, Xerox has instead a patented imaging carrier to transfer the image directly onto the paper. In Xeikon engines the drum is imaged and the toner transferred directly to the paper. In top-

end Canon and Océ presses, the toner is also transferred directly onto the paper.

Two manufacturers have presses combining electrophotography with an offset-like method to transfer the printed image onto the paper. HP Indigo's technology transfers the ink onto a blanket cylinder, just as in offset, and then onto the paper. Kodak's Nexpress uses a patented blanket cylinder, the Nexblanket, to transfer the ink. In most other respects the Nexpress and Indigo methods are different.

Kodak's Nexpress 2100

Single or Multiple?

These presses differ in their toner/ink transfer process: single or multiple pass. Single pass technology transfers the entire page onto the paper in one go. All four, five, six or seven colour separations are imaged or transferred one on top of the other and transferred via an intermediary carrier or blanket to the substrate in a single printing pass. Multiple pass technologies transfer each separation to the paper individually, either as the paper passes through the press in a straight path, passing one blanket cylinder or carrier cylinder after another. Another method is to hold the paper in place around a cylinder, which rotates four times (or more, depending on the number of

separations) and with each rotation another separation transfers to the paper.

Simplex and Duplex

All electrophotographic presses can print on both sides of the paper. This duplex printing is achieved in several ways. Usually the paper is turned upside down and printed on the other side so that what was the leading edge of the sheet for the first side, becomes the trailing edge for the second. This requires precision and accurate turning. Xeikon solves the duplex issue by printing both sides simultaneously – Xeikon web presses have toner units on both sides of the paper web.

The Nexpress has a different turning mechanism, unique to this press. The sheet is not only turned upside down but also horizontally, so the sheet keeps the same leading edge as it is printed on both sides. The Nexpress does not use conventional work and twist, but rather the sheet enters the first print unit with the same edge leading for printing each side. This avoids the need for special algorithms to adjust print register.

In all the top-end sheetfed digital presses, except the Nexpress, both sides of the sheets are printed before the next sheet enters the first printing unit, for a steady stream of sheets to the delivery. In the Nexpress a number of sheets (less than 10) printed on one side is collected in a tray prior to being printed on the other. They are then stacked up in the delivery at the same rate.

Toner or Ink

All presses use the toner or ink supplied by the press manufacturer. The printing methods generally require purpose made and patented toner or ink. Most use toner with varying

toner particle sizes, and many toners are so fine they flow like liquid.

The Main Players

Xeikon

In 2002 Punch Graphix acquired Xeikon's digital colour press division. Xeikon manufactures duplex web fed digital presses for the commercial printing market, but also has a single sided press for label applications. The company's Xeikon 5000 prints up to 130 A4 pages per minute and is built to produce over three million impressions per month. This web press is one of the most versatile engines

> ## Tim Evans, digital services manager at Image King Visual Solutions says that:
>
> *"DocuColor 6060 [gave] us the chance to enter the market for short-run, on-demand, quality output. [It] allowed us to move ahead in leaps and bounds - in speed, turnaround time, in quality, productivity and production time."*

available, capable of producing anything from banners, to multiple page gatefold work and posters.

It is a testament to great technology that this pioneer survived some difficult years. Apart from its ability to move quickly and work very intimately with customers, Xeikon is a small company and does not need to support countless management strata, so it can offer considerably more latitude when it comes to investment, service and cost per page,

compared to its larger competitors. If printing presses are like cars, Xeikon is the AC Cobra of the digital printing market.

HP Indigo

The other pioneer, Indigo, was acquired by computer and printer giant HP in 2002. This deal was vital for Indigo's survival, as competitors such as Xerox and Nexpress moved into the digital colour printing market. For HP, the speed and quality of the Indigo presses was particularly attractive. HP already offered both inkjet and xerographic printers, but Indigo gave HP a route into the commercial printing market. In 2005 HP acquired Scitex Vision, providing it with inkjet technology for the superwide format market.

Indigo develops sheet and web fed presses, the former usually for commercial printers and the latter for industrial applications such as labels and packaging. This dual philosophy still holds and HP Indigo has by far the widest range of devices and applications of any digital press supplier. HP claims to have shipped more than 40% of colour production printers in the world. There are now 3.4 billion pages printed annually on HP Indigo machines.

The latest presses are the HP Indigo press 5000 and 3050. The 5000 is the first press developed jointly by HP and Indigo, and the 3050 is an improved version of the HP Indigo 3000 series. Both were launched in 2004. The new web fed w3250 prints at up to 136 full colour A4 pages per minute.

Xerox

Xerox has been in the digital monochrome business for over thirty years. In 2002 early orders were taken for the iGen 3, a third generation high volume colour machine. The company now considers four of its products as

"digital production presses": the Xerox iGen3, the Docucolors 5252, 6060 and 7000/8000. Xerox recently introduced the iGen3 110 outputting 110 pages per minute.

conceived Nexpress as a joint venture with Heidelberg. The first Nexpress digital colour press was shown at Drupa 2000, and became commercially available in 2001.

The Xeikon 5000

Xerox may not be the market leader, but when it comes to market engagement this company can't be faulted. Xerox is building a new services led business model, taking it away from Xerox's traditional hardware core. This is smart because, as Armando Zagalo de Lima, President of Xerox Europe puts it: "you have different sizes of shoes depending on your specialty area". Never so true as in digital print. The company has restructured to provide customers with a single point of contact, Global Services, with the Office and Production, supporting digital printing.

Kodak

In 2004 Kodak acquired Heidelberg's Nexpress technologies, having originally

Technologically the joint venture had been a match made in printing heaven, with Heidelberg and its experience in sheetfed printing, and Kodak supplying imaging expertise. Heidelberg developed the press's mechanics and Kodak the image origination. Heidelberg's roots gave it a slightly different view of service, which has followed the press into Kodak. Many machines originating in office applications generate revenue for their manufacturers through click charges. The user pays for each printed page (click), and after a set number of clicks a technician arrives to service the machine. Conversely the Nexpress has over 40 parts that an operator can replace when necessary, thus controlling costs: it's cheaper to use an old imaging cylinder for a few Power Point slides, saving a new one for more important high end production.

13

In 2003 Kodak started to shift focus and in 2004 launched its Graphic Communications Group. Having dropped shedloads of cash to acquire KPG, Scitex Versamark, Creo and Nexpress, Kodak has bought itself a place in the market, and intends to become the most comprehensive solutions provider for mono and colour output, across the whole volume production market.

Canon, like Xerox, was originally a copier supplier but today the company has a clear graphic arts strategy, having been very successful with its CLC range. Canon bridges

the gap between top-end devices and entry level machines. The CLC 5100 and CLC 4000 are sheetfed presses that produce up to 51 and 40 A4 pages a minute respectively. This range also includes machines for entry-level applications, most notably the 32 page per minute CLC 3200. The CLC 5100 and 4000 are sold by Kodak as well. The two companies cooperate within digital print to develop a broad range of digital colour solutions to bridge office document workflows and commercial printing workflows, making the transition seamless.

Canon has a "breadth of offering to the industry that is strongest in the market" and no other company "has demonstrated the

same commitment as Canon" according to Adam Poole, Canon's Marketing Manager for Professional Solutions in the UK. How much of Canon's €24,422 million turnover comes from digital print is hard to say, but more interesting are the rate of growth of its contribution and the recent opening of a warehouse in Maasvlakte in the Netherlands to centralise and support Canon's European IT and professional print business operations. Presumably the rate of revenue growth from digital print is enough make investment worthwhile. Compared to its competitors, Canon has moved slowly so far, but with a new colour press on the way (see chapter 7), relationships with Kodak and Efi and very deep pockets, Canon is becoming a force to be reckoned with.

Inkjet

Inkjet is gaining ground. The resolution is still not quite what electrophotography offers, but it's getting better, and there are now high speed inkjet production devices capable of printing 300 x 1200 dpi, compared to the normal electrophotography resolution of 600 x 600 dpi. Indeed, speed is one of the advantages of inkjet printing – these presses can do speeds it's hard to imagine electrophotography ever matching. And while the trade off between print quality and speed is still there in high speed inkjet presses, it is slowly becoming less of an issue. Inkjet presses are still used mostly for industrial applications, such as packaging and transactional printing, but as quality improves so will the number of applications. Newspaper publishers are interested in this technology for printing newspapers on demand.

An inkjet press transfers the printed image without the imaging engine physically touching the substrate, so it's possible to print on a much wider range of materials than with

a press where the substrate passes through a cylinder nip (although not all inkjet presses are designed with this type of flexibility). The two main suppliers of inkjet presses are Kodak (the Versamark range) and Agfa, however Screen has recently entered this market.

An inkjet press transfers the printed image without the imaging engine physically touching the substrate, so it's possible to print on a much wider range of materials than with a press where the substrate passes through a cylinder nip.

Inkjet Engines

Inkjet presses are mainly used for industrial printing. There are two technologies: drop-on-demand and continuous flow. They are distinguished by how the drops of ink hit the printed surface. The two leading suppliers have developed quite different approaches suitable for different applications.

Drop on demand technology causes the ink to expand so that droplets are forced through an inkjet nozzle. Expansion occurs either because of electrical stimulation or as a result of heat and is controlled so that ink droplets are forced through the nozzle individually rather than in a steady stream, which is harder to control.

A continuous flow inkjet head allows the ink to flow continuously through an electrostatic field. This field charges some of the ink droplets, depending on what is to be printed so that a second electrostatic field can then direct the droplets to the print surface. This combination of charger and deflector means that droplet placement and frequency can be controlled with extreme precision so this technology is capable of very high quality, albeit at slow speeds. It offers a broad colour gamut, colour conformity and overall quality and is used in a wide range of applications. It has been especially popular for proofing applications. Continuous flow technology is more sensitive than drop on demand and can be vulnerable to clogging, particularly if the machine is not in regular use.

Kodak

Kodak's Versamark products are built around high-speed continuous flow inkjet engines, and the company offers monochrome, spot and full colour web fed configurations of its Versamark press lines. The Kodak Versamark V-series includes the VJ 1000, a monochrome press, and the colour VT3000, VX 5000 and 5000e. The VX5000e has the higher resolution of 300 x 1200 dpi. The Versamark D-series includes about a dozen imprinting products of varying widths, used to print variable information on- or offline. Kodak does not publicise installation figures for specific products, but we understand there are well over 9,500 Versamark units in worldwide production.

Agfa

The Agfa Dotrix is unique. It has print heads across the width of the paper web. The technology is called SPICE (Single Pass

Inkjet Colour Engine) and each individual print head cartridge has a printing width of 52 cm. The heads are mounted in a frame above the web in a staggered arrangement, so the maximum total print width is 630 mm (twelve cartridges). The print heads don't move, which gives stability as well as speed. Top printing speed is 24 metres per second.

The Dotrix is designed for industrial print applications such as wallpaper and floorcovering, speciality packaging, security printing and specialised printing applications such as mobile phone covers. There are 12 Dotrixes installed for different applications: labels (4), point-of-purchase and displays (2), packaging (2) and specialty printing (4).

Under Agfa's umbrella the scope for development is huge. It is interesting that Agfa chooses to invest in high speed inkjet, and it's a fair assumption that Agfa will look to move this technology into new markets.

Screen

Screen's new Truepress Jet520 is based on piezo drop on demand technology and prints a 64 mm web width at 720 x 320 dpi, with variable dot size. This single pass continuous feed engine prints 64 metres per minute to print 420 A4 pages per hour (pph). It is based on Epson heads with Screen engineering and manufacturing.

Conclusion

The press market has broadened considerably in the last few years, and today there is a digital printing system for every conceivable type of application, organisation and budget. Users trust the products, and are reaping the benefits of variable data printing, as people start to use print more imaginatively. The press vendors are large and stable and committed to long term development.

Diamond Class

The press release announcing the Xeikon Diamond Award winners said: "Valeri Art, Republic of Kazakhstan, public transport monthly tickets." It also said: "in 2000 the state company Centre for Public Transportation of the city of Astana wanted to produce monthly bus passes that could not be counterfeited". Kazakhstan? Astana? Bus passes? Counterfeiting? Were we intrigued because it all sounds so exotic, or were we intrigued because of the application? In all honesty a bit of both, but either way we couldn't resist taking a closer look. Red faced and ashamed, we had to start with an atlas.

Kazakhstan is one of twelve member countries in the Commonwealth of Independent States (CIS). This is the multilateral group of independent countries formed in 1991 after the break up of the USSR and Kazakhstan is the one of the bigger countries in the group. It sits between Russia and Belarus to the north, China to the east and Turkmeni-, Uzbeki-, and Kyrgyzstan to the south. The Caspian Sea and Afghanistan are to the country's west. The population of around 18 million people has a per capita income somewhere between that of Russia and the Ukraine, which are the largest and best known of the CIS states.

In 1997, the capital of Kazakhstan was moved by presidential decree back to its historic site of Astana. Astana is at the centre of Euroasia, located at the crossroads between east and west, north and south and it is hoped that the city will develop to become a sort of transport hub for the whole continent. Since 1997 the city's population has almost doubled, with most of the growth due to a

Case Study

Company:
Valeri Art

Claim to DP Fame:
The first printer in Belgium to use an integrated JDF network.

Headquarters:
Republic of Kazakhstan

Employees:
16

System:
Xeikon

Output:
Digital Print

Director Valeriy Vassilyev says:
"We do not consider ourselves as a printing company. Valeri Art is first of all a creative design studio".

thriving construction business and Astana's development as a cultural and political centre in the region. Modern communications are necessary for any effective political and commercial development, so considerable investment is going into developing efficient transport links, including local transport in the city. This is where digital printing and the Xeikon press come into the picture.

Bus Stop

Efficient transportation systems obviously depend on revenue protection, but it seems

this was a serious difficulty in Astana. Bus tickets generate a monthly turnover for the city in excess of US$1,000,000, a mouth-watering temptation for potential counterfeiters. Astana was losing a lot of revenue to bus ticket fraud, so the city asked Kazakhstan printers to come up with a solution. Valeri Art, a local print production company, got the job.

Valeri Art

Valeri Art is a privately owned company active in the Kazakhstan print market for over 20 years. The company has a reputation for expertise in design, digital and conventional printing and advertising, but its primary business is in creative project design. Since its first major digital printing project, the presentation of Astana as the new capital for Kazakhstan, Valeri Art has used digital

From left to right: Wim Deblauwe of Xeikon, Alexander Rankov, Xeikon's distributor in Kazakhstan, and Valeriy Vassilyev.

printing for all output. Valeri Art worked closely with digital press manufacturers Xeikon to develop ideas for presenting the new capital city, including a new logo, brochures and booklets. Valeri Art's owner Valeriy Vassilyev explains that "We were printing all the materials based on our own design drafts for seven days and nights without any breaks whatsoever. Our team

consists of specialists aged between 20 and 30 equipped with designing stations Apple Macintosh and PC, scanners of formats up till A3 (Umax Powerlook III and ICG360)." In 1998 the company acquired its Xeikon digital press, then and now the only such press in Kazakhstan. Besides its Xeikon DCP-32D press, Valeri Art has all the necessary finishing equipment to provide complete print production services in-house.

Valeri Art's largest client group is state bodies, for which the company provides services ranging from initial designs and repro, to printing the jobs. Since 1997 the digital press has been used to produce material for all sorts of high profile customers, including the Kazakhstan Parliament and the country's president, and in 2001 Valeri Art produced the print collateral to celebrate Pope John Paul II's official visit to Kazakhstan. The list of Valeri Art's design and print projects is lengthy, and its range of print products includes such material as prospectuses, booklets, calendars, invitations, programmes, postcards, journals, posters, diplomas, brochures, stickers and so on. It's pretty much what one would expect from a commercial printer, yet Valeri Art still considers itself a design house. Says Valeriy Vassilyev: "We do not consider ourselves as a printing company. Valeri Art is first of all a creative design studio".

Valeri Art's print runs range from single copies to runs of up to 3000 and all the printing is done solely on the Xeikon press. Variable data output is managed with Private-I 2.0, for full-page variability and unlimited run lengths. Data is archived to CDs and DVDs as both uncompressed and compressed data, depending on its perishability and data type. Incoming files are submitted to Valeri Art in .cdr (Coreldraw) or TIFF, with CMYK images at a minimum resolution of 300 dpi. Coreldraw is the most commonly

The Xeikon Diamond Award contenders: colour coded, numbered and security stamped bus tickets from Kazakhstan.

used package for prepress applications in Kazakhstan for historic reasons, so .cdr is the favoured format. It's what operators know and what they're used to, so they see no reason to change. Younger generations of operators may not feel quite the same way about it. CMYK is the preferred colour space for prepress and printers in Kazakhstan, so here too there is no reason to move to an RGB workflow yet. Colour is managed with a densitometer. This is one of the reasons Valeri Art wants to upgrade to the Xeikon 5000, which has an inline densitometer.

Preventing Forgery

The healthy trade in counterfeit passes meant that they had to be made harder to copy. Says Valeriy Vassilyev: "We've produced them since 1999. These traveling tickets for municipal transport are a kind of security, the monthly turnover for which surpluses US\$ 1,000,000. Therefore, there always was and still is a great temptation to forge them. Prior to our proposition they were made of paper and for protection holograms were used. However, such tickets were easily forged and the Ministry of Transport and Communication of

the Republic of Kazakhstan begun to look for an alternative solution that would prevent any forgery attempts."

The brief to Valeri Art was clear: design and print bus passes that could not be easily forged. Valeri Art combined a polyester substrate with variable data output for route numbering, with colour coding to denote different bus routes and ticket types, plus four colour black overprinting, microtext and serial numbers. The objective was to produce bus passes that could not be so easily counterfeited, thereby protecting the transport department's revenues. Valeriy Vassilyev explains: "Straight away we dismissed holograms and decided to print on plastic - DuraKote white (Hanita Coatings) additionally using most of the Xeikon protection capabilities. In particular, one of the most interesting ones, which I would to draw attention to, is black on black printing. This is our own know-how and it cannot be scanned for copying. Using plastic instead of paper allowed us to avoid any need for laminating and therefore prevented the possibility of hiding any defects of forgery behind a laminating cover. Furthermore, all a ticket controller needs to do is to try to tear the ticket. If it is impossible – plastic is impossible to tear whatever strength one uses – then the ticket is authentic. If not, it is a forgery that is easily detected. This very plastic is imported from Israel especially for these tickets and cannot be found anywhere else in Kazakhstan. Practice has showed that during the last seven years there has not been a single forgery case."

There are numerous different ticket designs, which vary each month, adding yet another disincentive to fraud: "altogether we have produced 250 varieties with monthly runs of over 70,000. We printed individual tickets for pensioners allowing for their personal details. Initially it was planned that they would be used for a year. But thanks to the plastic material they remained in almost their original condition after 3 years of use. Obviously this may be considered as lost revenue, but what can be of greater satisfaction than the satisfaction of the end user of your product. We are preparing our market for new generation of digital presses, the Xeikon 5000."

It's clear from this application that digital printing is less and less about the technology, and more and more about its use. The scope of applications for digital print is endlessly surprising as is evident from what Valeri Art is doing for the Astana transportation department. It might only be bus tickets, but when was the last time an American, European or Scandinavian bus company had the imagination to use variable data print so creatively? Transactional print economics aren't immune to colour, so maybe we should start thinking sideways. Could travel tickets be the next port of call for local advertising messages?

Variable Data Printing

Over the past few years, digital print has reached a point where it matches, and sometimes even surpasses, offset quality. Naturally the quality of the prints coming off digital presses is vitally important to the viability and acceptance in the market of digital printing. But what is really going to allow this 21st century printing method to take off, is its ability to produce unique copies. Variable data printing unlocks the real business benefits of a true digital press.

The industry's utilisation of the variable data printing capabilities of digital presses is clearly on the increase. Many printers continue to use their digital printing capacity to sell short run and on demand jobs. However, selling digital print on a price-per-copy basis means printers are not always taking full advantage of the press investment they have made. One reason some printers don't capitalise on their digital press's capacity for variable data print, is doubtless the complexities variable data adds to production. Even straightforward personalised print requires database management, adding work. Printing variable data is as much about data processing as it is about putting ink on paper.

From Mass to Fragmented Markets

The market for print used to be about mass communication, with huge volumes and low per copy prices. Low costs were achievable through economies of scale and highly efficient manufacturing. Low costs are now possible because prepress production costs

have fallen so dramatically in recent years. Print runs have also fallen dramatically and new factors, other than those that minimise per copy costs, influence market development. This is particularly true for on demand printing, a market that did not exist prior to the invention of digital production. Web based fulfillment, television shopping, the use of mobile phones for content transmission, all of these create potential new markets that print and printers can serve. These markets are however highly fragmented, diffuse and time sensitive, and will continue to evolve along

Effective Document Management:

UK 39%

Scandinavia 34.2%

Netherlands 35.9%

Italy 36.7%

Germany 36.4%

France 38.9%

Source: Pitney Bowes

these lines. To provide output production management in such environments, sophisticated data management including variable content capabilities is imperative. The good news is that a hefty premium can be charged for high quality, on demand, variable data and personalised print. Even better, end users are prepared to pay for it. In many markets and for many print applications the market's need is for high value print, rather than its traditional low cost equivalent.

Consumer behaviour is changing. While some claim media technologies are converging, consumers' media consumption is diverging. People want personal choice, and the market is responding. This may be bad news for some publishers, but it is very good news for printers and publishers who can provide services to match changing media usage and expectations. This is where variable data printing comes into the picture. Just as newspaper and packaging print have unique application driven requirements, so variable data printing applications are also usage driven. One-to-one marketing, customer relationship management, call centre fulfillment, direct mail, packaging and security solutions all demand different capabilities at the front end, and technology is evolving to meet them.

There are three classes of variable data print, and three classes of front end systems to support them. Transactional print is the most mature and familiar to most people and includes such things as utility bills, credit card statements and the like. This type of print is highly specific to an individual, but for the most part it is monochrome with no advertising. This is changing, with a rising use of colour and the gradual introduction of advertising messages. Agfa, Xerox, Kodak and Screen have all declared intentions to develop this market.

The second class is promotional work, which can first be printed in full colour, usually in offset, and then personalised in a separate run. This generally requires work with the data prior to print and distribution. The third class, complex variable data colour print, when used for one-to-one marketing, requires even more work in data preparation. However it yields far higher response than its conventional equivalent, particularly for direct mail applications. Of course the high response rates may say more about efficient prospect database

management than it does about the print and this is an important consideration when planning variable data print projects. Variable data content requires considerable investment into information technology (IT) and the resources to manage databases efficiently. The value of a fully variable publication is in the increased likelihood of a positive response,

and in its worth to the end user. There is also considerable value in the provision of relevant content, and in the savings in customer care.

The Front End – The Brain and Nervous System of the Digital Press

Digital print engines get a lot of attention: the quality they print, how stable they are, how fast they run. But without a front end, a digital press will be capable of nothing, so there is no point to in buying a high speed engine, if the front end can't feed it fast enough.

Front end systems are differentiated by their levels of processing capacity. In a digital press, the RIP is for rather more than controlling jobs and printing devices. An entry level technology won't support variable data efficiently, if it is also to keep up with the engine. A RIP for variable data

output must handle huge data volumes as well as cope with conventional tasks such as colour management, imposition, screening and trapping. Above all, the RIP has to be productive for the application, particularly for variable data printing. It should support the required data formats and common standards such as Postscript, PDF, PDF/X, PPML and JDF. Hardware and network foundations must also be able to handle the processing load.

> **Consumer behaviour is changing. While media technologies are claimed to be converging, it's obvious that consumers' media consumption is diverging. People are increasingly looking for personal choice, and the market is responding.**

There are numerous variable data software products on the market, used either by printers or print creators, to marry databases with document design. GMC, for example, has developed tools for personalised mailings, transactional print and variable publications. Low cost plug-ins such as Lantana's Variform PDF Pro, provide variable data printing and data merging using Acrobat forms. Pageflex

Mpower is for designing and producing Web-driven marketing communications. Output is based on variable data templates and printed via an Mpower server for on demand print applications. Sansui's Publishnow is based on PPML (see below), generating PDFs variable data direct or via Indesign. But these are not the same thing as a front end system. They cannot drive a digital press.

A digital front end and RIP system should support variable content and on demand print management, plus production functions such as colour management. Front end systems are press specific to take full advantage of an engine's capabilities. As a result, in many cases the supplier of the digital press also provides the front end options to go with their press. However, there are a couple of players specialised in developing front ends to go with other suppliers' presses. The leading such developer is Creo Print On Demand Systems, which although owned by Kodak, has been allowed to keep its identity because of the delicate nature of its business. Creo PODS operates independently with a charter that will remain sacrosanct.

Creo PODS is based on the legacy and intellectual property of Scitex and its intimate, longstanding Xerox cooperation. The group now has some 11,000 servers in the market, the majority of them sold in the last three years. It's apparently enough of a market presence to allow Kodak to let the group stick with the Creo PODS name, both for OEM business and for working with different groups within Kodak. Workflow management is what Creo PODS is all about, particularly managing variable data content flows and graphics production RIP processing. The company focused on high end applications until 2004, when it started serving broader markets with the introduction of RIPs for copiers.

One of its products is the HP Production Stream Server, which handles data transfers from Prinergy to the press. It has spot colour support and management of seven colour output. Creo PODS also has workflow systems driving iGen3, HP Indigo and Nexpress engines, optimising their productivity and driving maximum volume.

In the last two years Creo PODS has been designing for general and office markets, with front ends built for ease of use, but powerful and affordable. It looks like they may be

perspective it's just a matter of time". Creo PODS is also setting up a workflow partners programme for future integrated workflow management technology development.

Xerox is one of Creo PODS' most important customers. Xerox focuses heavily on its Freeflow range of workflow tools, one of which is its own DocuSP front end. The Freeflow products, which include Freeflow Web Services, Freeflow Process Manager and Freeflow Variable Information Suite can also be operated in conjunction with the front ends

The HP Indigo 5000

heading for Efi's territory. Creo PODS's first "headless" server is, according to Creo PODS general manager Ronen Cohen, "a platform for the future". The company also has a web based composition and personalisation tool for printers, and a new authoring tool for managing variable data in Xpress or Indesign.

The company has an impressive partnership programme, which it is extending. It now has over 30 certified partners capable of working with Creo front ends. Of the big names in digital printing only Canon's has been missing from the Creo PODS conversation so far. Ronen Cohen's comment on this is: "Canon is a company we are discussing with – from my

from Kodak and Efi which are also an option with Xerox's digital production presses.

Canon is a relatively new player for high end variable data colour print production. It is developing its partnership with Efi with which it has a new pan-European agreement to sell and support the Digital Store Front solution, and with Objectif Lune for its Planet Press Suite variable data production technology.

Agfa's variable data solution for the Dotrix press is designed for packaging, labels and POP. It is database driven, using PDF and works with Agfa's ApogeeX workflow system.

Agfa explains: "Referring to some variable data generators, for example for document printing, the above seams rather limited in functionality, but those variable objects can be generated on the fly, at full web speed (24 m/m). With the relatively high web width (65 cm) in combination with the linear speed, this is a nice piece of work. Thanks to the way of handling data/the implementation and the focus on industry requirements, the processing capacity is never an issue. No fancy features, but very efficient for industrial printing."

HP has the widest range of digital presses of any one supplier and arguably the most experience with variable data output management. All HP Indigo presses are supplied with the HP Production Flow digital front end, which is also a workflow tool. It automatically processes Postscript and PDF files and associated imposition, trapping, colour management and variable data processing, while managing multiple high performance Harlequin RIPs. HP Production Flow supports JDF, PDF and PPML (see below) and HP is keen to emphasise that the software is broadly compatible.

Kodak's Nexpress Nexstation is a workflow and press management system. Based on Adobe's Postscript Extreme architecture, Nexstation works exclusively with Postscript, PDF and VDX files without converting them to an internal format. The technology includes intelligent diagnostics and process management and can be scaled according to throughput needs.

Kodak's Versamarks have several controller options, each designed for use with specific customer workflows and input formats. The V-series uses the Kodak Versamark CS600 System Controller, a joint development with Efi, for printing applications in monochrome, spot colour or process colour. Efi's Fiery

QX9000 powers it; in-RIP colour and support for PPML are included.

In 2005 Punch Graphix introduced the X-800 Digital Front-End (DFE) for all Xeikon presses. It's an open, modular and scalable system designed for full automation. It supports Postscript or PDF-based print on

> The industry's utilisation of the variable data printing capabilities of digital presses is clearly on the increase, although it is still early days. Many printers continue to use their digital printing capacity to sell short run and on demand jobs.

demand work and PPML-based variable data printing. Options include in-RIP trapping and a barcode module to generate 1D and 2D barcodes after RIPping. Punch Graphix has also recently launched its native IPDS controller as an add-on module for the X-800 DFE.

Standards

By far the most important data standard for variable information printing is PPML, the Personalised Print Mark-up Language. PPML

- What RIP processing capacity do you need?
- Is the front end compatible with necessary standards (PPML, JDF, etc)
- How does it handle colour management?
- How does it link to your digital workflow?
- Is it scalable – could you for example drive several presses if needed?
- What data standards do your customers understand and use?
- What volume of existing output includes variable data?
- How can variable data management and production help you add value for customers?
- How much capacity do you have to manage variable data projects: IT, people, customer needs?
- What premium will customers be prepared to pay for variable data output on jobs of, for example, 1–10 copies, 10–50 copies, 100+ copies?
- How much are you prepared to invest, and for how long, to get a return on investment into variable data production capacity?

is actually a family of standards developed by a consortium of suppliers, the Print On Demand Initiative, or PODI. Based on XML, PPML has comprehensive support for pretty much any type of digital printing from high speed generation of document print streams, to control of inline equipment. However PPML lacks the features of many transactional protocols, such as AFP and IPDS, which in turn lack support for high quality colour imaging. PPML is therefore under development to become a suitable standard for transactional printing markets as well. PODI has also developed a job ticketing technology, the Digital Print Ticket (DPT) and CIP4, stewards of the Job Definition Format (JDF), are working closely with PODI. Many of the DPT concepts are being incorporated into the next version of JDF to improve support for digital printing workflows.

The original JDF specification didn't incorporate particularly profound support for digital printing. However this market is one where job ticketing and workflow automation are vital. PODI is therefore working closely with CIP4 to adapt the JDF syntax for digital printing. At the end of February 2006 CIP4 published the first ICS (Interoperability Conformance Specification) for digital printing which specifies conformance requirements for a subset of JDF defined as Level 1 integrated digital printing. This subset is useful for black and white and limited colour integrated digital printing systems with in-line finishing capabilities. This cooperation between PODI and CIP4 will continue.

Things to Consider

Variable data printing is as much about data management as it is about putting ink on paper. The capability of any digital press is determined by its front end. The choice of

digital press and application needs dictate the front end.

Digital printing's unique advantage is its ability to image variable data at high speed. This adds new dimensions to press and front end choice, IT, customer services, training and business development. Communication applications are changing, requiring new technologies, but a digital printing system can only truly be evaluated in the context of the business. Business requirements drive technology needs. Digital printing is not about quality, it's about performance, potential revenues, and value per page for customers.

Investment Issues & Factors

If you are thinking about digital print as a commodity – ink on paper – think again. Getting into digital print is about understanding customers and creating added value for services and products, otherwise the likelihood of profitability is low. For digital press investment, there are several issues to consider, both to do with the technology and the business aspects of the purchase. You must ask the right questions to get the answers you need from press vendors.

element. A profitable digital printing business creates added value for printed matter through for example, printing variable data, delivering just in time to save storage costs and so on.

Today's high end digital colour presses all produce reliable and consistently high quality print, so these are not issues to focus on too much. Capacity, flexibility, costs and finishing, plus the nitty-gritty of what the equipment can do, all matter, but more important are the business goals for a digital press.

According to Trendwatch in the US' 2004/05 research:

The number of design and production companies working with variable data:

Declined 4%
Stayed the same 22%
Increased 19%

The balance of people did no variable data printing in the previous twelve months.

Source: Trendwatch Graphic Arts

The days of digital printing mostly being about short run are over, although there are still many printers who use their digital press to compete with offset on price per copy for small jobs. However, when investing into a digital printing system, cost per copy is only one

Ask Yourself These Questions:

• Who are the customers and markets you intend to target?

• What problem of theirs should your technology solution and service solve?

• How do you intend to sell your services (current sales force vs. new sales force)?

• Does your current sales force have the skills to sell digital print?

• Who is your competition?

• What are the current market prices?

• What unique services beyond print can you provide?

• How much value can you add to the print?

• What is the TCOP (total cost of production) of the system including labour, usage charges, consumables, capital, electrical, space and so on?

• What support does the vendor provide to help you grow your business profitably?

• What skill sets (designers, programmers or others) do you need to acquire to implement this solution?

Press Vendors' Advice

When asking the press vendors about what advice they give a printer/prepress house looking to invest in digital print capacity, these are some of the responses we've had:

• Understand your customer's business, with an eye towards identifying particularly where colour printing or colour variable printing could add value, and identifying new possibilities to help solve your customers' business problems.

• Use an ROI business development approach, rather than just sell print – decommoditise print.

• Look beyond print quality. Good print quality for digital colour presses has become a commodity. All high-end digital colour presses provide good print quality. Perhaps specialists can detect differences between the prints of different products, but most end customers cannot. Furthermore, the true value of digital printing is in doing things that the traditional printing processes cannot, most obviously variable data printing. If you want to compete with offset for short run printing jobs, this is a very competitive and hard game to play. Unless there is a way of automating your job fulfillment procedures, for instance via the web, filling your digital press with short jobs can be cumbersome and costly. In other words, don't try to copy offset printing with digital printing. Look for aspects other than print quality for competitive advantage.

• Ensure the device you intend to purchase has the maximum flexibility and consistency for the types and quality of jobs you want to print. Once print buyers get a taste of what digital print can do for them, they increase their demands, but will never compromise on quality, look and feel, and delivery times.

• View the technology as an enabling tool within a larger strategic business plan, not as a strategy in itself. Leverage the key benefits of the technology to develop higher value applications, automate short runs, enable faster turnaround and personalised content.

• Invest in equipment and human resources to support the services you want to provide. Also, be willing to approach the business differently than you have in the past: change the sales approach to sell marketing programmes and projects, rather than print jobs.

• Exploit IT. If you want to make a success of digital printing, you have to be IT savvy. Handling files and data (not only for printing variable data), creating an automated workflow, is crucial for a modern and competitive state of the art digital printing business. For a digital printing company it is probably better to hire IT specialists and train them to understand print, than to do things the other way around. A good digital press and its digital front end system, can embrace and help leverage a good IT infrastructure supported by

IT smarts. Without IT there is no successful digital printing business.

• Service customers with services other printers don't offer. Present print in a broader picture, combined with preproduction, finishing, logistics, inventory, mail, and so on.

Agfa Dotrix SPICE heads.

• Investing in traditional printing may look safer than investing in digital, but this may be because problems in traditional print are just accepted. Digital print's added value needs a different approach to reflect its strengths so selling it can be more difficult. It requires more sales for smaller runs, and more prepress to prepare files for a digital press.

Looking at the Equipment

Support for Formats & Substrates

You must identify the physical boundaries of the print you want to produce. What formats should the press handle? Sheetfed presses, such as the Nexpress, Xerox products and some HP Indigo engines, print formats smaller than but not including A2 (B2 on conventional presses). Web fed digital presses are generally limited only by the width of the paper web,

but remember that even though you don't anticipate printing anything larger than A3, a sheetfed press isn't necessarily the best option. Run lengths and volumes also come into it.

The other physical boundary is the substrate. What range of stock weights can the press handle? And perhaps even more importantly, what substrates can it print on? Will you be able to print on papers supplied by your paper supplier, or will you need to buy special papers? There may also be more substrates for some presses than others: quality web fed substrates are fewer than sheetfed. Find out if a substrate is guaranteed for your press or merely described as compatible, which may affect print quality. Many press vendors supply their own papers, but you should not have to use proprietary papers for optimal results.

In France Data One project manager Paul Jean Straebler:

" We already had full colour printers with near offset quality, but they lacked the necessary speed [and] that meant we had to turn down lucrative work from clients whose jobs demanded 48 hour turnaround times. Data One was the first in France to offer variable full colour printing at industrial speeds."

Push the Button or Fully Flexible?

A "green button" device requires little operational skill: press the button and start to print. A green button system may also demand less calibration and operator intervention to

assure highest quality. At the other end of the scale are presses requiring skilled operators to achieve optimal performance, but which allow more flexibility for specialised needs. Obviously suppliers of any good press, whether green button or not, will provide operator training. However, where in the spectrum does

> **To invest in the most cost effective press, you need to know your anticipated monthly production volume. If you only plan a few jobs per day shift, don't buy a 100 page/minute high end press.**

your business fit? It may look like a trade-off between operating security and operating flexibility, but nothing is so black and white. Many vendors have sophisticated systems for quality control, including automatic calibration and colour management. When you invest in a high end, complex printing system, such things help give peace of mind.

Digital Front-ends

There are also two extremes of front end systems. Flexibility versus performance requirements are determined by device throughput and complexity of work. Variable content data management requires much heftier computing and processing power than spot colour, static, short run work. Front end

choice depends on the engine and the type of work it produces.

Capacity

To invest in the most cost effective press, you need to know your anticipated monthly production volume. If you only plan a few jobs per day shift, don't buy a 100 page/minute high end press. Several smaller devices produce good quality colour and cost considerably less than their bigger siblings, albeit at a slightly higher cost per copy. On the other hand, the top end machines are built to run 24/7 and produce monthly volumes of 1–1.5 million prints, or more in some cases. Get the volumes right because a press run beyond capacity will have problems before its time and may incur increased click charges. A press run below capacity be less cost efficient.

Press speeds vary and there are three categories: devices outputting 30 A4 pages a minute, devices printing roughly 60–100 pages, and high speed, low resolution inkjet. When comparing speeds, make sure you compare like for like: different vendors use different measurements. Speed varies with coverage, resolution and for simplex or duplex printing.

The productivity of a digital printing system is not only determined by print speeds, but also by front end capacity, change-over times and finishing. These are harder to quantify, so maybe just ask "how long does it take to produce 100 each of three A4 eight page brochures?".

Costs

Some press vendors have official product price lists, others do not. List prices give a hint of investment requirements, but don't tell the whole story. Unlike traditional printing

presses, a digital press generally includes a service contract. Furthermore, the printer is obliged to use consumables, such as ink or toner and spare parts, supplied by the press vendor.

Press vendors talk about different costs such as cost of ownership, total cost of production or total cost of print, generally using the term which best suits their business model. Beware that when one press vendor advertises a page cost, this figure may not necessarily be directly comparable to a figure given by another vendor. Identify what is included in the page cost. For example, is it an estimated cost of service and toner or does it include labour and paper? Ask each vendor to specify exactly what the figure includes: what percentage of CMYK toner coverage, at what run lengths, on what paper, running on how many shifts, and so on. Or specify your own parameters.

Cost of ownership covers everything related to the equipment, including depreciation/lease costs, repairs and maintenance, utilities to operate it, insurance and related costs. Cost of production covers everything related to the running of the press: labour, space, utilities, service, consumables, paper, stop-and-start times and so on. Interestingly, more than one vendor claims to offer lowest TCOP. Beware that by this some vendors mean total cost of production, others total cost of printing. Find out which applies and look meticulously at the figures to find out what they actually reference.

Most digital press vendors charge a certain amount for each print (click) produced on a press to cover service. Click charges are based on monthly page volumes and increase if production goes up. Kodak operates a model without click charges for its Nexpress. Printers can decide how far to "stretch" the use of the consumables to drive down costs. Consider writing a separate consumables contract to guarantee a maximum level of consumables costs per page. If the level is exceeded, the user should be credited with the difference.

Also consider financing options. You could buy the equipment outright, or lease it. If you lease it you will pay more than the original cost but lease payments are fully tax deductible and can be expensed, rather than amortised. Leasing also means you'll be able to upgrade your machine more frequently. If you've purchased the press outright, it may still be productive even after you've paid it off.

David Torok, president, Padgett Printing, USA:

"Implementing a complex digital workflow is not for the faint of heart. We knew that the key to a successful digital print business was to establish a dependable workflow that would keep an assortment of presses running efficiently."

In the End

Crucial to digital output productivity is the finishing. Inline finishing solutions are managed from the print engine and integrate directly with the press. Offline solutions are separate from the printer and nearline solutions are somewhere between the two. Not mechanically connected to the printer, they process jobs, via an electronic interface to it or by reading optical marks on printed sheets. With a nearline solution, several engines can feed one finishing system. This is true for offline solutions too, but without the added efficiency of automatic job recognition.

No doubt the nearline philosophy has merits, however you need to evaluate what will best suit you. An inline system is only as reliable as its weakest link: a production stop in one component could affect the entire production chain. But an inline system may offer labour savings, better production tracking and so on. A vendor should be able to support both environments, but ultimately it is up to the customer to determine which offers the best solution for their environment.

When considering finishing, you also need to take into account how the actual printing process affects the ability to finish the products. Some electrophotographic technologies produce more heat than others, drying out the paper and generating static electricity, which could cause problems in finishing. In most presses this is not a huge issue, but it's worth keeping in mind. Inkjet technologies are cold, and therefore do not suffer from these problems. If you want to varnish or laminate the printed paper, find out what processes are compatible with the press technology you consider.

What Do You Expect from the Vendor?

All digital press vendors have proper service organisations in place, but satisfy yourself that your supplier will be able to support you. How much training is included with the installation? How long will it take for a service technician to reach you in case of problems? How long will you have to wait for emergency spare parts? And so on.

The best way to find out whether a press vendor lives up to all the sales and marketing promises is to talk to existing users. However you do it, remember it's better to ask too

many questions than face a nasty surprise. The vendors want to find a solution that suits you, so raise all your queries early.

Digital Printing Suppliers

In this Technology Guide we focus on high end digital colour presses, whether they use electrophotography or inkjet technology. Of course, digital printing encompasses a lot more, from desktop inkjet to superwide format printers, but these applications are not included here. Direct Imaging presses, which differ from true digital presses in that they cannot image variable data content are described elsewhere in this book. We focus here on engines that print variable data content.

Agfa

Agfa's focus is very much on being a total solutions provider and by virtue of being such a big player, Agfa aims to lead product development in the graphic arts industry. It has recently restated its very firm commitment to inkjet printing. According to the company, the inkjet market will be worth €10 billion by 2010 so Agfa is developing a complete inkjet portfolio, from slow to medium production rates, for example fo displays and point of purchase material and billboards, to high volume industrial inkjet. It includes different inkjet technologies and systems, such as multi-pass and single-pass inkjet, binary and grey scale, narrow, medium and wide web, roll-to-roll and flatbed, fully digital or hybrid.

With its Dotrix acquisition Agfa moved into high speed inkjet printing, and industrial digital print production. The Dotrix product is unique in that it has print heads all along the width of the paper web. In the SPICE (Single Pass Inkjet Colour Engine) technology,

each individual print head cartridge has a printing width of 520 mm, and is mounted in a frame above the web in a staggered arrangement. Maximum total print width is 630 mm with 12 cartridges. The advantage of this construction is that the print heads don't move, providing stability as well as speed. The print engine is built on a roll-to-roll web transport system, and with an optional infeed and outfeed module, can be connected to external converting equipment such as jumbo unwinders or sheet cutters. The Dotrix is for industrial applications such as packaging and label printing, high volume sign and display printing, and decorative printing. It uses primarily UV curable inks, required for many industrial printing applications, but is not limited to one type of ink: Agfa develops different inks for specific applications.

Agfa sees the Dotrix as unique, not comparable to other digital presses. The company states: "In every market segment/application there are different competitors, with a different format/size and/or technology. For example, in labels we believe there is a place for both Indigo and Dotrix, for different reasons: size, ink type, speed, and quality. In displays we are often competing with traditional printing: screen, litho, DI. In POP [point of purchase] we are niche compared to the many wider format inkjet printers. In flexible packaging we are an alternative to flexographic printing, not really a competitor."

Within finishing, there is no single standard in industrial digital printing. It is up to the customer to decide whether he wants to run inline or offline finishing. According to Agfa: "Customers with a well defined workflow

and higher volume runs will very often opt for in-line finishing. Let's not forget that the sum of the set-up time, equals the down time. Customers requiring a very flexible workflow and many short(er) runs will try to optimize the press time, for example by using a standalone digital [press] in combination with off-line or near-line finishing."
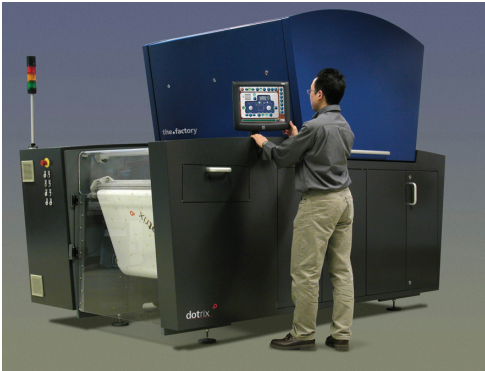
The Agfa Dotrix

Canon

Canon is getting very serious about high end digital printing. According to Per Klavsen, Canon's Director of European Professional Solutions Marketing, the company now has 167 people dedicated to the commercial print market and plans for 474 people by 2008.

Canon entered high end digital printing some years ago with the introduction of the Canon CLC 5000 digital colour press. A couple of years ago, it launched the CLC 4000 and CLC 5100 production colour systems.

Until quite recently, some other vendors disputed that Canon should be included in this market segment, but today there is no doubt that the company is on its way to becoming one of the major players in high end digital printing. Canon is developing its partnerships, particularly with Efi and with

Gretag MacBeth. It has new pan European agreements with Efi to sell and support the Digital Store Front solution, and with Objectif Lune for its Planet Press Suite variable data production technology.

Most importantly of all Canon is introducing two new digital production engines: Imagepress X and Imagepress Y, due for commercial shipment this summer. This toner based technology is a totally new design and most definitely "not a CLC in another box". It is a huge investment for Canon, which has built a new factory dedicated to the Imagepress's manufacture. A digital front end co-developed with Efi drives both models: 70 ppm A4 simplex or duplex engines, with new toner fusing, imaging and front end technologies, plus Canon developed finishing.

The X high volume version complements offset, supporting multiple finishing options, as does the Y model. The X has a 10,000 sheet air assisted feeder. According to Per Klavsen, these engines offer "lower investment and running costs than the market is used to now". The Y is a high speed SRA3 machine with finishing options that include saddle stitching, high quality colour output and support for a range of substrates. It will work for proofing, on demand and short run colour print.

Canon has looked at the possibility of adopting a service strategy based not on click charges, but on enabling the user to do more of the maintenance, exchanging of parts, etc. However, after researching customers' needs, the company has come down on the side of click charges, and states: "Canon has had a range of internal pan-European strategy teams in place over the past 18 months preparing the launch of Imagepress technology. We have looked at specific customer issues including how customers will want to construct their business models in the future and finance

Imagepress and other press technology from Canon. We firmly believe that click pricing meets the majority of potential users' needs at present as it allows them to cost jobs and plan accurately as they know precisely the running costs. In addition to this, in line with our customer focused approach we continue to look at other options for our customers to ensure that we can deliver the business packages they require to help grow their business in the future."

Delphax

This 400 person operation is a market leader in security and book printing. The CR2000 monochrome 600 x 600 dpi engine prints 1968 A4 pages per minute using Electron Beam Imaging technology. Using the principle of corona discharge, the print head produces a controlled pattern of electronic charges, with one electron beam produced for each dot to be imaged. The patterns of charges are applied to an image belt or a drum made of anodised aluminium. This is in contrast to first charging the image drum surface and then removing the toner as an electrostatic device would do. The latent image thus forms on the image belt or the transfer drum and then attracts special magnetic toner particles. The toner is first transferred to a heated transfer belt, rather like the blanket in an offset press. The toner heats up, melts and then gets pressed into the preheated substrate. The company is researching ways of using this technology cost effectively for colour output and will have a prototype colour engine this year.

Domino

Domino has previously supplied only monochrome engines but has now developed a full colour inkjet web press for variable data printing applications. This high resolution drop on demand machine, based on high speed Spektra heads, is designed to keep up with presses from the likes of MAN Roland and Müller Martini when mounted inline. It is designed for commercial print and includes a secure print solution.

HP Indigo

HP has recently restructured its business in order to focus on professional output markets, as distinct from office and consumer markets. It has established a Graphics and Imaging business to include the superwide devices from what was Scitex Vision, large format engines and HP Indigo digital press technologies. The new division is going after a market HP estimates to be worth $10 billion by 2008. HP Indigo's presses are based on the original Indigo print engines, using Electro Ink, a patented liquid ink. It has a 1–2 micron particle size and is a crucial component in this printing technology. The company has by far the widest range of products, and is the only

supplier in this market with both sheet and web fed electrophotographic presses.

The sheet models for commercial printing applications use multi-pass imaging which HP calls multi-shot, whereby one colour separation is created at a time on a Photo Imaging Plate (PIP) cylinder, and transferred individually to the blanket and onto the substrate. The substrate stays on the impression cylinder for several rotations as it receives each separation, printed separately one after the other. As the final separation is printed, the substrate is delivered for duplexing or to the output tray. HP Indigo's web fed presses use a single pass process, as it is not possible to wrap the material around the impression cylinder for multiple passes. In this case, the PIP cylinder rotates several times transferring a succession of separations and building them up on the blanket before they are transferred to the substrate, all in the same impression pass. This process is also relevant for HP Indigo's industrial presses printing on thick and stiff substrates like cartons and plastics.

HP Indigo organises its presses into the following categories:

• Commercial presses sheet to sheet, with various levels of productivity and automation in the production of marketing collateral (HP Indigo Press 1050, r1000, 3050, 5000)

• Specialised presses for industrial printing which can be web to web or sheet to sheet, either in typical segments of packaging industry like label conversion or in specialty printing environment (s2000, ws2000, ws4050)

• Sheetfed or webfed presses or for one-to-one direct marketing and manual or book printing (5000, w3200)

• Sheet to sheet for photo related applications like photo albums, calendars, etc (3500, 5000)

The HP Indigo press 3050 is designed for 150,000 to 300,000 A4 pages per month, while the HP Indigo 5000's monthly volume

HP currently has more than 3000 Indigo presses installed worldwide. HP Indigo has seen its installed base of one million+ duty cycle machines increase by 600%. There are now 3.4 billion pages printed annually on HP Indigo machines, a 40% year on year growth over 2004.

is 700,000 and is positioned against the Xerox iGen3 and the Nexpress. On the industrial side, the w3200 is built for 24/7 use and monthly volumes of up to 3 million A4 impressions.

These presses can print six or seven colours and the seven colour presses using special colours HP provides, allow users to match 97 percent of Pantone colours. HP also lists flexibility of substrates as a key selling point.

For the next few years, HP states: "Our goal is to develop the best digital solutions as a compatible alternative and complement to conventional printing. We are extending our range of the best digital print solutions, to provide the only true offset quality digital solution, while delivering a more economical total cost of ownership (TCO). This will translate into increased productivity, flexibility and a full portfolio of end-to-end solutions that can easily be integrated into conventional production environments."

HP currently has more than 3000 Indigo presses installed worldwide. HP Indigo has seen its installed base of one million+ duty cycle machines increase by 600%. There are now 3.4 billion pages printed annually on HP Indigo machines, a 40% year on year growth over 2004. HP Indigo claims to have 42% of the installed base of "high end colour" machines, with Xerox at 26%, Nexpress at 23% and Xeikon at 9%.

Kodak

Over the past two to three years, Kodak has gone from having limited activities in digital colour production presses to being a top player. It is the only company backing both inkjet and electrophotography in the high end production market. Kodak intends to be the most comprehensive solutions provider in the imaging business. The prepress and digital printing industries for mono and colour output are of particular importance: they generate huge print volumes. There are well over 10,000 Kodak branded print units in production.

Most of these are Versamark print heads; the company has not published figures for the Nexpress.

The industrial inkjet operations which constitute the bulk of Kodak's customer base were added in December 2003, when the company announced its acquisition of Scitex Corporation's wholly owned subsidiary Scitex Digital Printing, developers of the Versamark range of inkjet presses. The Versamark products are built around high-speed continuous flow inkjet engines, a technology which has been improved and developed over more than 30 years. Kodak offers monochrome, spot and full colour web fed configurations of its Versamark V-series. The company also offers the Versamark D-series of imprinting products, mostly used for variable information on- or offline. The D-series printers are mostly distinguished by the print width available. Some print spot and process colour.

The V-series prints on 60–160 gsm roll-fed papers. It consists of the VJ1000, a mono engine printing at 300 x 600 dpi, the VT3000, which can be configured for mono, spot or process colour and prints at the same resolution, and the VX5000. It has 11 possible configurations to print mono, spot or process colour. The VX5000e prints enhanced resolution at 300 x 1200 dpi, good enough for text down to 4 points, according to Kodak.

Kodak lists a number of main selling points for its Versamark presses including the ability to integrate them with a range of other solutions, such as inserters, web presses and complete printing systems. The high production speeds – from 100 to 305 metres per minute – is another key selling point, along with the machines' low cost of operation. States Kodak: "The rugged reliability and industrial design of Versamark printing solutions combined with

low cost consumables ensures that customers will experience very low running costs for their digital output. High uptime and reliability ensures maximum throughput and low service costs. Consumables for Versamark printing systems are often less than half of the cost of consumables for other technologies. Kodak Versamark V-series printing systems can produce process colour images for below $0.02 per A4 impression (Total Cost of Printing – hardware, consumables and full maintenance)".

The Kodak Versamark

Kodak's electrophotographic offering is the Nexpress, a press designed and built specifically for the printing industry. Unlike many electrophotographic presses, with no origins in office printing, the Nexpress has over 40 parts an operator can replace themselves to control costs. The new Nexpress 2500 prints 2500 A3 pages per hour (83 A4 ppm) with a redesigned transport mechanism suitable for a wider range of substrates, a fifth imaging unit for glossing and an inline booklet maker.

Kodak says: "The Nexpress uses the same leading edge for registration when perfecting. This means the front-to-back registration is the best in the industry. It has a blanket cylinder to transfer the image from inking stations to substrate. This means you can

print on a wide choice of substrates, and the imaging cylinder is protected from the abrasive surface of the paper, thus improving quality and decreasing costs. The Nexpress provides continuous long-term printing thanks to three sheet feeders, a sizeable dry ink capacity and delivery area up to 600 mm. Both paper and dry ink can be added during a press run without interrupting the job. It handles a variety of paper stocks and weights (coated, uncoated and textured) all at full engine speed. This means special pre-treatments are not required and maximum throughput is maintained. It was designed to be maintained by the press operator. All of the major component areas and usage parts are easily accessed from the front of the press. This means the press operator can quickly service or change parts without special tools. The result: greater uptime and better control over expenses."

Konica Minolta

Konica Minolta is also getting very serious about entering the professional graphic arts market. The company already has a 51 ppm colour press, the Bizhub Pro C500, and a couple of monochrome sheetfed devices, the top one being the Bizhub Pro 1050, which produces 105 A4 pages a minute.

Océ

Océ isn't quite what you would call a major player in the professional colour production market, mostly because the colour output quality of Océ's machines hasn't really been up to muster. Océ is the market leader in monochrome transactional print, and claims to be number three behind Xerox and Canon in xerographic colour production. This does not correspond with the market view of other suppliers. Key to Océ's future is its Copypress technology which requires no developer and so is not subject to temperature or humidity

variations, nor does it need calibration. It is based instead on Océ patented electromagnetic technology and low temperature pressure fusing. Copypress is the basis of the company's new, much improved colour press the CPF 800/900. Production speeds are 30/33 A4 ppm.

Océ has toes in many pools including commercial print, document services, wide format and display graphics, and something it calls "corporate printing". Breadth rather than depth seems to be Océ's approach.

Screen

This company, best known for its Direct Imaging press and computer-to-plate products, is entering the high speed inkjet market. The new Truepress Jet520 is based on piezo drop on demand technology printing a 64 mm web width at 720 x 320 dpi, with variable dot size. This single pass continuous feed engine prints 64 metres per minute to print 420 A4 pages per hour (pph) and is based on Epson heads with Screen engineering and manufacturing.

The Truepress Jet520 uses water based pigment inks and has a scanning quality control system to monitor application of ink to standard or coated paper. The device's front end is based on Screen's workflow know-how plus an Adobe Postscript RIP with AFB and IPBS drivers for transactional markets. Support for AFP suggests that this technology might also be of interest to IBM, one of the world leaders for transactional print. Truepress Jet520 is available as a simplex or duplex machine for a range of applications such as direct marketing, transactional print, manuals, statements and newspapers.

Xeikon

Xeikon is one of the two original developers of electrophotographic digital colour presses.

Owner Punch Graphix has an installed base of over 1200 active Xeikon engines, a figure which has remained static for the past couple of years. This company is unique, in its deliberate commitment to niche applications.

> **Punch Graphix comments: "In high quality we have the most productive digital colour press available on the market today. Productivity is a combination of speed and reliability.**

The Xeikon presses are all web fed and based on a unique duplex printing technology whereby both sides of the web are printed simultaneously. Early in spring 2004, Xeikon launched the 5000 press, but it also continues to sell the Xeikon 500 and the 330. The flagship 5000 press is capable of 130 A4 pages a minute and the duty cycle is three million 4/0 A4 pages per month for direct mail applications (10% CMYK single paper type, long runs and three shift operation) or 1,500,000 for graphic arts applications based on 35% CMYK pages with medium run lengths and the press running for two to two and a half shifts per day.

Punch Graphix considers Xerox iGen3, HP-Indigo 4050 and Nexpress to be its main

competitors: "In the digital label market there is only HP Indigo and Xeikon. In the on demand printing arena we encounter Xerox, HP Indigo, Kodak (depending on the application). In the direct mail and transactional playing field our competition consists of Xerox and Kodak (Versamark)."

Punch Graphix comments: "In high quality we have the most productive digital colour press available on the market today.

7000/8000 and the Xerox iGen3 and iGen 3 110. Docucolors use a digital blanket as part of the xerographic process, which means there is an extra step, via a cylinder in the ink transfer compared to the iGen3. IGen3 uses a single transfer technology to transfer the image onto the paper. According to Xerox, this gives the iGen 3 superior image registration and quality. The new iGen 3 110 is capable of printing 110 A4 impressions per minute, while the newest of the smaller machines, the Docucolor 5252 prints 52 pages per minute. The iGen 3 110
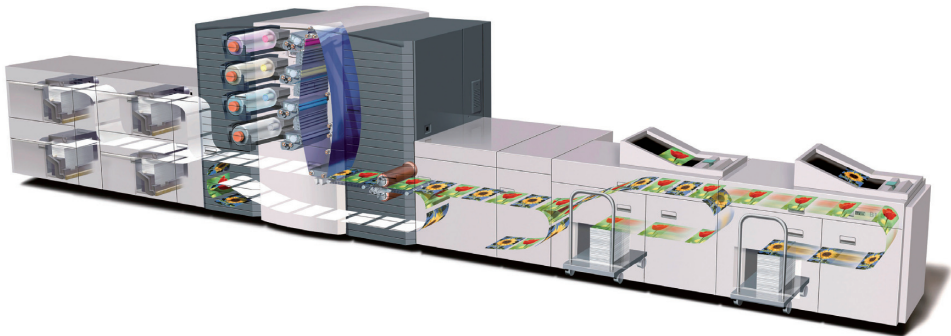
Xerox has sold around 800 of its iGen3 variable data presses, shown here illustrating the paper path.

Productivity is a combination of speed and reliability. Furthermore our format and substrate versatility is unmatched. Finally there is the one pass duplex capability that is highly appreciated in the document printing markets." The company also says that: "Independent research by consulting companies has always confirmed that our running cost is about the lowest, if not the lowest (depending on the conditions)." Punch Graphix also offers its customers the opportunity to buy all the different consumables and usage parts separately from the press.

Xerox

In the colour digital production press category Xerox has its Docucolor 5252, 6060,

has expanded page size so that it is now a true 4-up digital press, to better suit graphic arts production.

When asked about the main selling points for the Xerox presses, the company refers to three areas: the right technology, the right workflow and the right business models. While technology and workflow are fairly self-explanatory, Xerox says: "The right business model focuses on helping our customers build profitable businesses in digital printing by providing resources that go beyond the printed output. In our years of experience, we have assembled the industry's most comprehensive collection of tools, training and support that we make available to our customers to ensure their success in digital printing. This really

goes beyond the points mentioned above [technology and workflow], so that once a system is installed, there are resources available to help the customer in all aspects of their business – whether it's training their sales force in selling digital printing, developing a marketing plan, hosting an open house, or even determining the most cost effective device (offset or digital) to run a job on."

Whereas several of the digital press vendors will not comment at all on the competition, Xerox is very helpful and has provided the following description of the various digital print markets (we are not able to verify this information, so please note that this is Xerox's particular view of the world):

"In the light production monochrome market, Xerox and Canon are the market leaders. Xerox has market share leadership in Europe and is second to Canon in North America. As the market has transitioned from analogue to digital, both companies have focused on enabling that migration.

"For light production colour, Konica is the market leader in both Europe and North America as they entered the market with a good product with an aggressive pricing strategy. We have not seen second half [2005] market share results, but given the volume of placements of the Xerox 240/250 products, we believe we will regain significant share back from Konica in this segment.

"For high end cut sheet monochrome production printing, Xerox is still the market leader and continues to invest in leadership technology with the Nuvera product family.

"In the continuous feed area, Océ and IBM are market leaders and are either one or two in both North America and Europe and have a combined share of over 85%.

"For high end colour production printing (defined as 60+ pages per minute), Xerox has market leadership. Kodak Nexpress and HP Indigo have made progress in the very high end of the market, but Xerox has the broadest portfolio of high end colour production devices."

PHD Mail's business development manager, Kevin Dunn:

"We were a direct mail company back in 1999 and in 2000 we started looking at the business and wanted to get more into transactional printing. We saw it as less cutthroat, more stable and felt it could level out the peaks and troughs of direct mail work." Most crucially, "Turnover rocketed from £700,000 to a projected £2.8 million in 2006/7."

Conclusion

Suppliers claims are all well and good, but evaluate them on what they mean for your business. What differentiates suppliers is their involvement with customers, their service, contracts, training and business support. These plus technology are the criteria that determine how your business benefits from digital press investment.

Direct Imaging Presses

The idea of a building a CTP system into a printing press always seemed to us slightly absurd. Why have a press waiting while imaging plates? But Direct Imaging presses with built-in platesetting have gained ground and there are now 2,500 or so in day-to-day production. There is a market for them and we were wrong.

> We estimate there are roughly equal numbers of DI and digital presses used just for variable data output in the market. There are about 2,500 of each, and representatives from both camps are about equally optimistic when it comes to the speed of market growth.

The race for a true digital full colour press started soon after Postscript turned mainstream. Heidelberg was first to recognise the combined potentials of standards based,

direct digital output to press, several years before Indigo and Xeikon introduced their digital presses. These engines and their competitors, with variable data output capacity have an indisputable advantage over the DI presses. But the market for variable data output is still far from huge and many printers seem to be opting for DI presses.

We estimate there are roughly equal numbers of DI and digital presses used just for variable data output in the market. There are about 2,500 of each, and representatives from both camps are about equally optimistic when it comes to the speed of market growth. HP Indigo, for example, expects that the number of digital presses installed will double in two year's time (excluding DI-presses) to several thousand. Presstek has invested vast sums into DI imaging heads and plates, has now introduced its own press it clearly expects to sell in the coming years. Heidelberg however, has abandoned this market entirely, which probably says more about the company than it does about the market.

Is there a battle raging between variable data and DI presses? Having spoken to DI press users and read many DI case studies, the picture is a little more complex. This isn't a battle about one technology versus another; these technologies are symbiotic not mutually exclusive. Users often have both, with variable data digital presses for variable data jobs and very short runs, and the DI presses printing small to medium and even large runs. Contrary to what we believed, DI presses handle substantial print runs well. However, even though some of the DI plates are rated for 150,000 impressions, most users are printing DI runs of around 20,000 copies.

The Second Generation DI Presses

The first DI presses came to market roughly ten years ago but the print quality wasn't great. Designed for fast makeready so that printers could compete for short run work, time has worked in DI's favour. Print runs get shorter and print buyers expect fast job turnarounds and delivery. DI print quality has also improved with time.

This is the latest DI-press on the market, the Presstek 52DI. It's a landscape 52 cm B3 format press, using processless plates and waterless printing technology.

Several press manufacturers have shown DI prototypes over the years, and then quietly left the market. Heidelberg released its second generation technology, the Quickmaster DI, in 1995 and dominates the DI market for sheetfed DI presses. Prior to leaving the market Heidelberg competed with KBA, Kodak, Ryobi and Screen in this sector. A few manufacturers have shown prototype web offset DI presses, but only MAN Roland and Wifag can deliver functioning products.

The first DI presses were designed for fast makeready and ease of use. However, manufacturers had to compromise to balance performance and price, and so the presses could be easy to operate but not too expensive. Efforts to build a compact, small footprint press, sometimes compromised on quality. To achieve short plate exposure times, resolution was kept down, compromising print quality. That has all changed and no longer is mediocre print quality a given with DI press output.

Second generation DI presses reflect innovations in all areas of print technology: new and improved plates, new and faster exposure units operating at higher resolutions, and better and more automated colour control on press. The printed resulta look superb.

More & Better Plates

Several DI presses image roll-fed polyester-based plates, another limiting factor for first generation engines. It affected both registration and run length; Presstek developed a polyester based plate with a thin titanium layer on the plate to overcome these limitations. The material can be delivered on rolls, but it has the precision of a single sheet aluminium plate.

An alternative is to use aluminium plates which is the case for larger presses, such as Heidelberg's Speedmaster 74 DI and KBA's 74 Karat. An ideal plate should be able to hold 200 lpi, but some plates can achieve 300 lpi and even support fine grained FM screens. The range of processless aluminium plates suitable for DI presses is growing. Beside plates from manufacturers like Agfa, Kodak, Konica-Minolta, Mitsubishi and Presstek, Fujifilm has presented new processless plates which may be developed for DI. Several of these plates are designed for waterless printing, eliminating the need to balance ink and dampening water. Waterless printing requires temperature regulation on press, since waterless printing

inks are heat sensitive and vulnerable to temperature fluctuations.

But not all presses are waterless: the Screen Truepress uses conventional water based printing technology. In the interests of easy operation, the balance of ink and dampening solution is automatically controlled. This technology was developed for DI presses and could well find its way to wider use.

Automated plate mounting on DI presses provides exact and even plate mounting on press. And, since exposure occurs inside the press onto mounted plates, plate imaging accuracy can be hard to match on conventional presses.

Faster Lasers at Higher Resolutions

When the first DI presses were launched, the technology for computer-to-plate was very new and not well proven, but today we use second, and even third, generation lasers and exposure units. The plate exposure technology for DI presses varies, but the goal is to image sufficient resolution to support high screen rulings. Common technologies are those used to image thermal, processless plates. Presstek's Pro Fire Excel imaging system is used in DI presses from KBA and Ryobi. Screen uses its own imaging technology, the Multi Array Laser Diode (MALD), to expose Konica-Minolta plates in the Truepress 344 in about five minutes. Clearly with exposure

times at around five minutes for B3 plates at resolutions of 2540 dpi, today's DI technology matches even very high print quality demands.

Better & Easier Colour Management

Ultra modern and highly automated colour management is common to all DI presses. This includes complete JDF based presetting and the use of scanning spectrophotometers or densitometers for colour control. In some cases, measurements are made in the press, with the press control system automatically adjusting ink densities.

Printers Vignold in Austria has a DI press for producing long proofing runs, up to 50 copies, and often printed on many substrates and paper qualities. Michael Adloff, director of the technical department, said that Vignold evaluated the KBA 74 Karat as the company had tested proofing systems: "We found that the 74 Karat could match the FOGRA Media Wedge [part of the Altona Test Suite] with an average colour deviation of less than 4 Delta E. As a reference we asked more than 30 different printers to print the same test form on conventional presses. Only less than a third of them could match the colours to the same narrow tolerances as we could in the 74 Karat."

Michael Adloff conducted his test three years ago, when the press was purchased. His conclusion, even three years ago, was that DI press print quality is at least as good and stable as that of conventional presses.

DI Presses

Most of these engines are available in most markets, but the situation with the KBA 46 Karat and Kodak Direct Press 5634 models

is a little special, a mess in fact. Both presses are really a Ryobi 3404 but the situation is complicated because Kodak doesn't market the Direct Press 5634 in Europe; and Presstek markets the KBA 46 Karat, which is the same technology. In Scandinavia the same technology, called the Ryobi 3404 DI, is distributed through MAN Roland. Or at least, we think so.

KBA (Koenig & Bauer)

KBA introduced the 74 Karat in 2000, as a joint venture with Scitex. It is a four-up press for formats up to A2+ (52 x 74 cm). The central impression cylinder is triple width and serves both of the two blanket cylinders, which in turn are double width. They serve two plate cylinders each, making for both compact design and a small footprint. It is possible to use only two imaging heads, each serving two plate cylinders. Presstek manufactures the imaging units and the 74 Karat has an automated inking system called Gravuflow. This is a keyless inking system, that brings the press up to colour very quickly. Since the printing technology is waterless, there is no ink-water balance to maintain. Automated temperature control optimises printing conditions for the waterless inks. The press images Presstek's aluminium based processless plates loaded into two 20 plate cassettes on the press to enable ten automatic makereadies. Ink is loaded into specially designed cassettes for easy and fast handling. The RIP is a Brisque.

Since 2002, in parallel with the 74 Karat, KBA has also marketed a DI press for 2-up, or A3+ (34 x 46 centimetres) output, called the 46 Karat. It is really a Ryobi 3404 DI, in a dressed up design to look somewhat like the 74 Karat. The configuration of the cylinders is similar to that of the 74 Karat and the central impression cylinder is triple width, serving both blanket

cylinders. These in turn are double width, serving two plate cylinders each. The imaging units are manufactured by Presstek, and it takes about four and a half minutes to expose four plates. The RIP system is based on the Harlequin Postscript interpreter.

The 74 Karat from KBA uses waterless printing technology and is a four-up press (52 x 74 centimeter sheets). Some use it as a proofer for longer print runs.

Makeready on this press takes a little longer than the exposure time, because the plates are automatically dry cleaned prior to printing to remove loosened silicone and other particles. According to Jon Walbank at Absolute Digital Print in Kendal, UK, the press is up to colour after only 10–20 sheets. Absolute Digital combines a "true" digital press from HP Indigo with a DI press. Print runs over 500 copies are planned for the 46 Karat, and the really short run and variable data work is done on the HP Indigo machine.

Kodak Direct Press 5634

This machine is also a Ryobi 3404 DI, but it has an outer look to suit Kodak. There are two configurations: the 5634 is fastest with six laser diodes per imaging head and the 5334 has only three laser diodes per head, so it's slower. When Kodak acquired Creo and

evaluated which products should remain in the portfolio, it was uncertain for a while whether the Direct Press would remain. Kodak has decided it will, as it complements Kodak's other digital presses, the Nexpress and the Versamark. The RIP system currently used in the Direct Press 5634 and 5334 is Direct Works, based on Harlequin Scriptworks.

The Kodak Direct Press 5634 is yet another DI-press based on the Ryobi 3404. For Kodak it is a complementary product to the other digital presses in the portfolio, the Nexpress and the Versamark.

Presstek

Presstek recently launched the Presstek 52 DI which is built by Ryobi, but carries the Presstek name. The fully automated Presstek 52DI is the world's first landscape format two page 52cm B3 format, common impression cylinder direct imaging press. It has increased automation and improved ink key technology and incorporates AB Dick's feeding technology. The Presstek 52 DI has the same V-shaped 5-cylinder design as the 34 DI and the KBA 74 Karat DI. This patented design is a triple diameter press with 16 ink zones across the sheet for better colour control. Ink profiles are set automatically when a job is RIPped and a pre-inking plate cylinder means the press comes up to colour quicker, within 20 sheets. Makeready is fully automatic

and unattended with a total makeready time of around nine minutes for the first saleable sheet. This includes a 2.5 minute plate wash and 4.5 minutes for plate imaging. As with most DI-presses it's supposedly easy to use.

The 52DI waterless press images 10,000 impressions per hour with the Presstek Profire Excel imaging head exposing 16 micron spots at a fixed resolution of 2540 dpi and up to 300 lpi. Presstek considers this sufficient to hold FM screens. There are 45 plates per roll of advanced Pearldry technology-based plate material and the top sheet size is 520 x 375 mm for prints up to 510 x 360 mm. The 52DI images and prints in landscape mode for inking efficiency and throughput.

Ryobi 3404 DI

Besides manufacturing conventional presses and DI presses licensed to KBA and Kodak, Ryobi manufactures and markets its own DI press. The Ryobi 3404 DI's design is apparently inspired by the 74 Karat, and Ryobi cooperates very closely with Presstek to develop its DI technology, manufacturing the press under licence from Presstek. The Ryobi 3404 is a two-up press, or A3+ (34 x 46 centimetres). Presstek Pro Fire Excel imaging units can generate a 300 lpi AM or FM screen. The Ryobi 3404 can be configured with six imaging units, each with four laser beams to expose the plate, or with only three lasers and taking twice as long to expose a plate: nine minutes instead of four and a half. The Ryobi 3404 images Presstek polyester based processless plates and is waterless. The inking system is temperature controlled to suit the waterless printing technology. After exposure the plates are automatically washed off. The RIP is based on Harlequin Scriptworks, and accepts 1-bit TIFF data from a range of other RIP systems. The press control system supports JDF and so can use presettings for faster make ready.

The idea is that the press operator should be able to start the run with just one click of the mouse. The Ryobi 3404 can be extended with UV curing units as well as an infrared dryer. The infrared dryer helps reduce the need for powder sprays, and so offers a cleaner working environment.

Screen Truepress 344

Screen introduced its first DI press, the Truepress 544, in 1998. The new Truepress 344, launched in 2004, is totally redesigned and twice as fast. The Truepress 344 prints 7,000 A4 prints per hour and is a two-up press for A3+ format (34 x 47 centimetres) applications. Screen has designed the Truepress and manufactures the imaging head, with part of the manufacturing subcontracted to the press manufacturer Hamada.

The Multi Array Laser Diode (MALD) exposure units image the plates in five minutes. The plates are Konica-Minolta's polyester based processless thermal plates and the printing technology is conventional water based offset. After exposure there is no silicon debris, so the plates don't need washing before printing starts. Since conventional water based offset printing demands a tightly controlled ink-water balance, the Truepress has an automated function which, coupled with inline density measurements, offers very fast makeready and a reduced number of waste sheets. Screen recommends the Trueflow RIP, but the imaging system also accepts 1-bit TIFF data from a number of other RIPs.

Provided the RIP system can handle JDF data, the Truepress can use presettings delivered in JDF to speed up makeready even more. Makeready should take about five minutes, but actually takes five minutes and twenty seconds according to Ian Relf at Creative Digital

Printing, UK. Ian evaluated several different DI presses before settling on the Truepress. Creative Digital had entered the digital printing arena with an HP Indigo digital press in 2001, but soon found that slightly longer print runs dominated customers needs. The company started to look at DI presses and soon decided on the Truepress 344. Now months the company splits jobs between the Truepress 344 and the HP Indigo.

The Future of the DI Presses

For many years, we pooh poohed the idea of putting a CTP system inside a printing press. Having spoken to many DI users and having studied the technology more carefully and thoroughly, we are converts. DI presses serve the market, not as alternatives to digital presses producing personalised print and variable data, nor as replacements for the bigger conventional sheetfed and web fed offset presses. But when it comes to print runs, say from 350 to 2000 copies, it's hard to beat the DI presses for price and performance. They can print longer runs as well, generally up to 20,000 copies and some plates even manage print runs up to 150,000 copies. As we have seen in several case studies, the combination of a "true" digital press and a DI press is often attractive, particularly as these engines compare favourable with conventional presses.

Some technologies developed for DI presses, like inline density measurements and simplified user interfaces, will find their way into conventional presses. Heidelberg recently announced such an addition to their bigger press models. In sheetfed markets, DI presses are economic for short and frequent runs. Be they DI engines or variable data digital presses the number of installations can only rise.