

New Products and Technologies at Drupa 2000

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Abstract

Drupa is a landmark within the printing industry for the introduction of new production printing systems. However Drupa 2000 may well be the first Drupa to witness the launch of more in-press imaging printing systems and electronic printing systems than conventional printing presses. Since nearly all content that is created and prepared for publishing, has been processed in a computer system, a computer-to...output device is now the method of choice.

In addition to advances and adaptations of existing technologies, several new technologies will be presented for the first time; with the potential of having a big impact on the printing and communication industry. Certain production requirements can be addressed and new fields of application created, depending on the technology applied by using a permanent master or a variable image carrier. Among the many novelties we will see, are tools to support the trend towards integration of the whole print production process. This paper will discuss some of the prominent technological developments exhibited at Drupa and their implications on future markets.

Introduction

The output media for visual publishing can be grouped into three columns or core technologies, which form the basis of the related industry: the conventional printing processes, non impact printing and the display technologies. While the first two technologies display static information and are also called hardcopy technologies, the latter is mainly used to display dynamic content. This paper will focus on the latest developments in both hardcopy technologies and derived hybrid technologies.

Hardcopy output has a fairly long tradition and went through many changes since. Especially with the advent of digital technologies, the impact on printing technologies and the speed of development has been tremendous. But the presentation of new technologies and products for hardcopy publishing is not a steady stream of announcements, rather it seems that the introduction of innovations is triggered by special events as fairs.

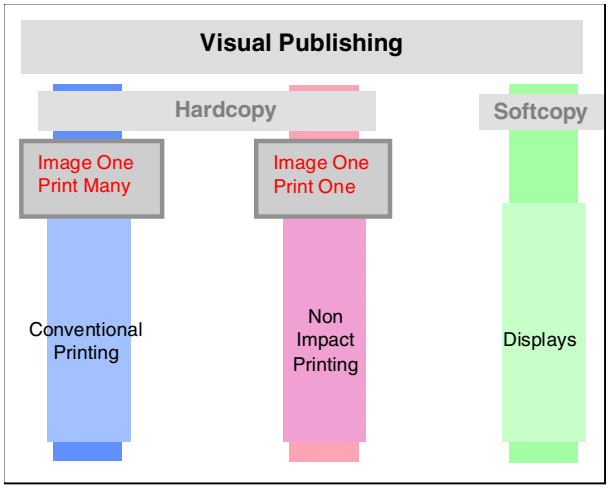

Figure 1: Visual information output processes

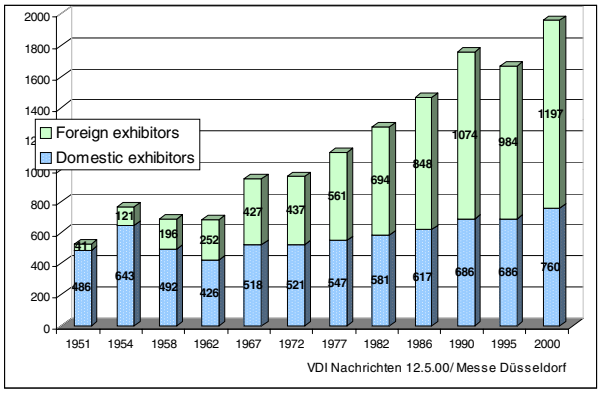

Figure 2: Number of exhibitors at drupa

The major show for hardcopy production systems is the German fair drupa. The fair has been founded in 1951 with the main focus on printing presses. From modest beginnings as a mainly national fair, drupa evolved to the world major presentation place for all kind of printing equipment for the graphic arts industry. The fair is held every four or five years and the last drupa took place in May 2000. After the two-week event ended on 31 May, 413,500 visitors from 171 countries attended the biggest fair for the printing industry. One in two visitors came

from outside Germany, no fewer than 28 percent of whom traveled to Düsseldorf from overseas. 1957 exhibitors covered a space of more than 160.000 m². The prime focus of the fair is still the printing industry and the associated businesses of post-print processing, paper converting and package production, together with the associated consumables. But digital printing, new media, pre-press and pre-media constantly gained importance and are today only second to printing presses itself.

As expected with the record number of exhibitors and exhibition space many product announcements have been made on drupa. And due to the great number of digital output devices the trade press declared drupa 2000 the "digital drupa". Some highlights will be presented to illustrate the transformation of drupa from a printing press oriented show to an exhibition place for all kind of hardcopy output systems.

Conventional Printing

Many new printing presses have been announced on the show and certainly a great number of improvements in speed, quality, ergonomics and investment cost have been made. And especially automation of the printing process is an area, which stands out as a field of improvement. But it would be an extensive task, to list all progress made on the various new or improved products. On the other side real innovations in conventional press design are rare.

The two most prominent developments should be singled out and covered in more detail.

Metronic

The German printing machine manufacturer Metronic introduced the prototype Gemini press. It is a small format A3 sheetfed offset press, capable of printing 6000 four color sheets per hour. By using an anilox short inking system for waterless offset and integrated UV-drying, the press is extremely compact. All units are arranged around a common impression cylinder. It the smallest four color offset press to date and has approximately the size of an average office copier and according to Metronic also the same ease of use. The press is supposed to be available next year.

KBA Cortina

KBA presented with the Cortina a new concept for webfed newspaper printing units. Again an anilox short train inking system is used for waterless offset printing. Although much larger than the Gemini, it is less than half the height of conventional newspaper printing presses with identical printing format. The double impression units for two sided printing are stacked as a tower, with a vertical web in the middle. To be compact and still offer access to all components, the printing tower can be split in the middle, where normally the web would be located. Both halves of the printing tower can be moved apart on rails and the operator can step inside the press to gain maintenance access to the plate and blanket cylinder. Afterwards both sides can be joined and locked to resume printing. Plate feeding is automated.

A comparable press design is used by the Japanese press manufacturer Myakoshi. The ALB20A is a webfed press, targeted for commercial printing. The same stacked tower design for two sided printing is used. To gain access to the inner components, in this case, only the outer parts of the press tower are moved on rails. The middle third is stationary, but offers still enough access to the plate cylinders.

Non Impact Printing

The presence of non-impact printing systems and manufacturers on drupa 2000 increased by a great number and are now an accepted hardcopy production method within the graphic arts industry. Major surprises and breakthroughs have been scarce, but the real significance is the fact, that the number of presented systems more than doubled.

Table 1: Color production digital printing systems (>25ppm)

Vendor	Resolution	Grey-levels	ppm*	Process
Aprion	600	N		Ink-Jet
Barco/Xaar	360	Y	12-220	Ink-Jet
Canon	400	Y	31	Electrophot.
Elcorsy	400	Y	1700	Elcography
Nexpress	600	Y	70	Electrophot.
IBM	600	Y	130	Electrophot.
Indigo	800	N	33-266	Electrophot.
MAN Roland	800	Y	32-130	Electrophot.
Minolta	600	Y	32	Electrophot.
Océ	400x1600	N	25	Elektrophot.
Scitex	300	Y	1000-2000	Ink-Jet
Xeikon	600	Y	32-130	Electrophot.
Xerox	600	Y	40-130	Electrophot.

* Letter-Size images in 4-color at maximum speed

Distinguishing between office and document printing and graphic arts production printing becomes increasingly difficult. In general the required printing speed, the quality level and ease of image data supply determine which system is considered to a be production printing system. Of course this distinction can not be very sharp. And grouped together as a cluster printing system with a common print server, as TR Systems offers for example, also office type output systems can reach a considerable speed. On the other hand, there is still a big productivity gap compared to conventional printing systems. Only the fastest non impact production printing systems can barely match the speed of an average offset lithographic printing system and none can match the quality level yet.

An important aspect for the relation of non-impact printing systems and conventional printing presses is, that they serve different markets and applications. Especially the unique advantages of digital printing, the variable data capability and the instant availability of the print, are features not completely understood by most traditional printers and print buyers. Creating the markets, discovering special niches and complementing the strengths of both process will determine the speed of the introduction of non-impact printing processes.

Barco/Xaar/Metronic

One interesting product came out of a cooperation of three manufacturers with totally different background. Barco, a pre-press company, also well known for their platesetters and displays; Xaar, a manufacturer of ink-jet heads and Metronic, a manufacturer of small printing presses.

Presented on the Barco booth as "the.factory" and exhibited on the Metronic booth as well, the system is a roll to roll ink-jet printer. It is very compact, with a footprint of 2 x 2.4 m. The ink-jet print heads are manufactured by Xaar. The heads use the drop on demand principle with PZT actuators. A shear mode deformation of shared walls between the ink nozzles causes acoustic waves in the ink. The pressure wave created by the deformation of the Piezo crystals then releases the ink droplets from the nozzle at very high speed. The droplets merge to produce a single dot with multiple gray levels. The Xaar print head is capable of jetting 5000 droplets per second with 8 gray levels (1). Each Ink-jet head is only 70 mm wide, but multiple heads can be stitched together in "the.factory". Up to 6 different colors can be used and the inks are UV curable, which allows a great number of different substrates. The system base is manufactured by Metronic and has a scaleable architecture. Up to 9 print heads for each color can be mounted to cover the maximum printing width of 630 mm or 25". The printing speed on the fair has been limited to 5 meters per minute but 21 meters per minute is the aim until the commercial introduction in 2001. The system is driven by an front-end system from Barco and can be addressed as any other output device supported by Barco.

Indigo

An interesting example of versatility and modularity are the printing systems presented by Indigo. The Series 2 print engines offer some advancements in the unique Indigo unit design. But main features, as imaging resolution, to use of liquid toner for multiple colors in one printing unit and the heated intermediate for toner transfer are still unchanged.

Based on the traditional design of the imaging unit and the new type of imaging unit design, 13 products have been presented on drupa 2000 in different configurations. Available are sheet-to-sheet, roll-to-sheet, roll-to-roll and versions for special substrates. The number of offered colors per press configuration can range from 1 to 7. Also memory and personalization capability vary according to the desired level.

Black and White Systems

Though most of the attention on graphic arts exhibitions is spend on color printing systems, also monochrome printers should be mentioned. The demand for monochrome printers has been fueled largely by in-house printers, copy shops and document printers. For that reason the big success of the Xerox DocuTech series took place nearly unnoticed by the traditional printing world. But production methods and business models are starting to change.

Table 2: Manufacturers of monochrome digital printing systems

Manufacturer	System speed in ppm*				Paper supply
	< 100	100-200	200-500	>500	
Canon	X	X			S
Dainippon Screen			X		S
Indigo		X			S
Heidelberg		X			S
Océ	X	X	X	X	S/W
IBM	X	X	X	X	S/W
Scitex				X	W
Xeikon (Nipson)		X	X	X	W
Xerox	X	X	X	X	S/W

* letter size images per minute

Also traditional manufacturers from the press and pre-press business are joining the monochrome market. After the acquisition of the digital printing division of Eastman Kodak, Heidelberger Druckmaschinen now manufactures a monochrome printing system, the Digimaster 9110. Similar in the features to the DocuTech, the system has a slightly slower speed with 110 ppm. The Digimaster is also sold by IBM, Canon and Danka. Another new entrant to the monochrome market is Dainippon Screen with the TruePress V200. Similarly named to the direct imaging presses, the TruePress V200 is an electrophotographic dry toner system with two imaging system for duplex printing. The resulting speed of 400 ppm is quite impressive for a sheetfed monochrome printer.

Both well known color non impact printer manufacturers for the graphic arts industry presented new monochrome printing systems. Indigo introduced the Ebony as a monochrome printer. It is simply the same unit as the e-print, but without color capability. After the acquisition of Nipson by Xeikon last year, the former Nipson presses have been presented under the new company name and with new design.

Hybrid Technologies

Hybrid technologies connect both worlds, they link technologies of the conventional printing world with technologies of the non impact printing world. In all cases digital

data are used to produce a material output, i.e. a printing master, which is not the commercial product itself, but is used to finally generate the desired end-product(s). The final step to produce the hardcopy output is done by a conventional reproduction method.

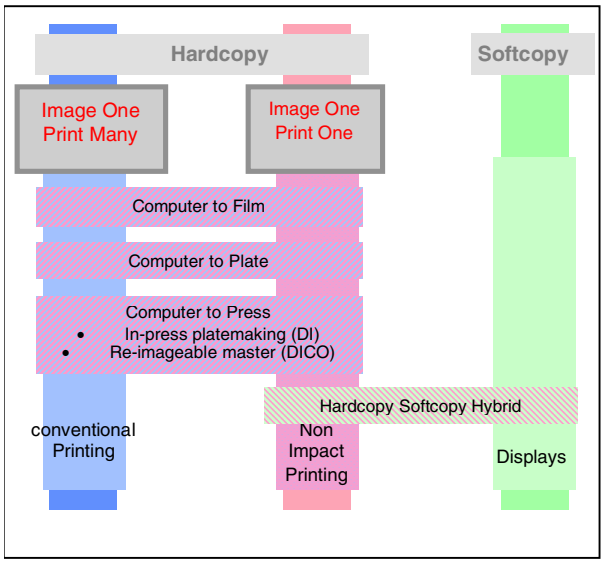

Figure 3: Overview of hybrid technologies

Altogether four technologies connecting the conventional printing world and the non impact printing world can be distinguished:

- Digital proofing
- Computer to film
- Computer to plate
- Computer to press

It is interesting to see, that each of the last drupa fairs marked the breakthrough of one of the technologies. The first widespread presentation of digital proofing systems and digital film output came on drupa 90. The drupa 95 was widely acknowledged as the drupa of the computer to plate systems. Drupa 2000 has been the drupa of the computer to press equipment. While always the previous drupa saw one or two forerunner products of each hybrid technology, for example on drupa 95 the first direct imaging press has been presented, the next fair has been the place of a widespread introduction from a substantial number of suppliers and for a wide range of target applications. Although a larger distribution at customer sites usually takes another two or three years, the drupa sets up the orientation point for the all manufacturers and potential users of the technologies.

Computer To Plate Technologies

By the time of drupa 2000 the computer to plate technology or platesetter technology has been a widely accepted, although not as widely adopted technology.

As expected the products became more reliable, easier to use and more cost effective. The most interesting trend and a real driver for this product group has been the violet laser technology. The trigger for this development did not origin within the graphic arts industry, but from a completely different sector: DVD-players; coincidentally a technology for storing and retrieving primarily dynamic content. Manufacturers, offering a violet laser platesetters, amongst other laser types, report, that violet laser platesetters accounted for about 80% of their sales. Despite the fact, that these platesetter will only be available later this year and plate sources are very limited.

The driver of the demand has not been the desire for higher quality, although violet light permits the exposure of much smaller spots than IR light sources. This feature has not been implemented yet. And also the plates, at least for the near future, are not less expensive than other plates for use in platesetters. The main driving force is the price and availability of violet lasers. Thermal laser have a limited life expectancy due to their high power output and the replacement of the laser imaging system is relatively expensive, since the complete imaging heads are proprietary developments of graphic arts suppliers. Violet lasers on the other hand are expected to be a commodity in the DVD-player market and even the adaptation for graphic art applications will not make them overly expensive.

Still thermal imaging technology offers benefits, violet laser technology can not offer, especially the potential of processless plate generation. Depending on the application this can be one of the most decisive factors. Therefore the race is open and it is up to the market to decide which technology will be applied.

The ingenuity and creativity of especially smaller companies found its way into some interesting products.

Basysprint uses an UV light source to expose conventional, cost effective and readily available printing plates. To image the printing information, a mirror chip with 800.000 discrete elements is used to expose an area of 2 cm² or 0,3 square inch. In a step and repeat process, the area of the printing image is covered. Areas without printing image can be spared out.

Another smaller manufacturer is the Swiss company Lüscher. The 4Page! images printing plates like a CD-writer. The plate is clamped on a sort of turn-table and spins around its center, while the laser moves on a linear path from the center to the outside, writing a spiral. This results in a very simple design of the computer to plate device.

Computer to Press

The most apparent trend on drupa 2000 was the advent of a great number of direct imaging printing presses. In essence, digital data are transmitted to the printing press and a permanent master is produced inside the press. The master is used to reproduce the desired number of identical copies in a conventional printing fashion. So far all direct imaging presses use the offset lithographic printing pro-

cess, and are either equipped for waterbased offset printing or waterless offset. This determines the type of inks used, the paper requirements are like in conventional offset printing. The advantage of this hybrid technology is, that it utilizes ink and paper types already used in a large number of printing presses. The relative simple requirements and the fierce competition of the consumable manufacturers keep the cost per copy down. If there are multiple copies of a document are required, these type of presses become quickly less expensive as non-impact printing systems, despite the required set-up cost. On the other hand, computer-to-press systems are more cost effective than conventional presses for shorter runs, as they rationalize and speed-up the image change process. Only for long runs, conventional presses with external plate making are more cost effective, due to the deadlock costs of the imaging equipment, which would be idle during long press runs. The break-even points between the three basic designs: non-impact printing – computer-to-press – conventional printing are blurry and subject to change. The break even points are influenced by technical factors as: consumable prices, speed and investment cost; and by production aspects as: cost of labor, end product requirements, finishing, quality level, logistics and turnover time.

In total 11 computer-to-press systems have been presented live at drupa 2000. In general two types of machines can be distinguished:

1. In-press imaging using a plate or similar permanent carrier (10 presses)
2. In-press imaging processes with an erasable printing surface (1 press)

In case one an image forming-layer linked to a form carrying material, commonly called plate, is used. The image-forming layer does not contain any printing information when fed into the press. Inside the press, the form can be imaged first and then moved to a position for production printing, where inking of the form and transfer to the blanket takes place; or can be moved to the latter position first and be imaged there. In both cases, a plate or other carrier material gives the printing image its stability during the print run. After the print run the image-forming layer, and with it the carrier material, has to be discarded.

In case two the image forming components do not have a base material or they do not have an intermediate carrier which is suitable to be directly printed from. During the imaging process the image forming substances are transferred to the form cylinder surface, where later on the printing process takes place. The printing image resides directly on the form cylinder surface. The dimensional stability of the printing image during the print run is achieved by the form cylinder itself. After the print run is completed, the image forming substances have to be removed or covered.(2)

Table 3: Computer to press systems

Manufacturer & Type of press	Type of master*	Paper supply	Max No. of color	ppm**
Adast 547 DI	Thermal plate	Sheet	5	400
Adast 745 DI	Thermal plate	Sheet	6	667
Dainippon Screen TruePress 544	Light sensitive plate	Sheet	4	133
Dainippon Screen TruePress 744	Light sensitive plate	Sheet	4	533
Heidelberg Speedmaster 74 DI	Thermal plate	Sheet	6	1000
Quickmaster DI	Thermal plate	Sheet	4	333
Karat 74	Thermal plate	Sheet	4	667
Komori Project D	Thermal plate	Sheet	?	?
MAN Roland DICOweb	Plateless erasable	Web	Not limited	2667
Ryobi 3404 DI	Thermal plate	Sheet	4	233
Sakurai Oliver 474 EPII-DI	Thermal plate	Sheet	6	867

* method of producing the permanent master

** 4 color letter size images at maximum speed

Platebased Systems

Most products using direct imaging today, use a precoated plate as permanent master. Two types of press design can be distinguished in that area:

- Presses designed especially for in-press imaging
- Traditional press designs with add-on plate imaging

Presses designed specifically for in-press imaging have a very compact design and take advantage of the fact, that a computer-to-plate press does not need some features, normally present in lithographic printing presses. In general, they have a high level of automation and need less manning. On the other hand they are limited to 4 colors and can not use externally imaged plates. An example for that type of press is the Karat 74, which has two plates for two colors on one plate cylinder. The inking systems touch alternatingly the respective plates and the sheet of paper hits the plate cylinder, twice to pick up both colors.

Traditional presses with add-on plate imaging need to be adapted to integrate a plate imaging equipment. They can nearly be as modular as conventional sheetfed presses and can use externally imaged plates in most cases as well. Each color is printed in a separate unit, therefore these presses have a much larger footprint. They also need some adaptation to take in the imaging system and access some

parts of the press can be difficult. A more recent example of this press design is the Adast 547 DI. The press has an linear unit design, with one unit for each color and all necessary tools to take in and register plates. It is as PAX-DI also available by Presstek, the manufacturer of the imaging equipment, and by Xerox. The press can be driven by the Xerox Digipath front-end. This is incidentally the first printing press to be offered by Xerox.

Thermal Transfer Process

The only product with an erasable permanent master has been the DICOweb by MAN Roland. The applied technology is called the thermal transfer process. The process comprises of three major steps

Step one:

The imaging material is a thermal transfer polymer coated on a ribbon. This ribbon is brought into close contact with a form cylinder surface. As the form cylinder spins, the ribbon is unwound from a cartridge. A high power IR-laser heats the thermal transfer ribbon according to the desired image. The polymer is transferred to the cylinder surface and adheres to it. Ribbon and laser traverses the cylinder width to cover the complete printing area. The transferred polymer is ink receptive, the uncovered cylinder surface is water receptive.

Step two:

After imaging a fixing and conditioning step is applied to improve the printing conditions. A contactless heating element heats the form cylinder and the transferred polymer. During the conditioning process a conditioning liquid is applied to improve the water receptivity of the image-carrying cylinder and to ensure excellent printing conditions. Afterwards the printing process can start using conventional wet offset inks. All copies of the run are identical, since the imaging process only takes place between print runs,.

Step three:

After the desired number of copies has been printed, the press is stopped. Residual ink has to be removed with an organic solvent. Than a de-imaging liquid is sprayed onto a cleaning cloth. The cloth removes the polymer from the form cylinder surface, similar to a blanket-washing device After the de-imaging step, the surface of the form cylinder is totally clean and ready to be re-imaged.

Press Design for Erasable Form Production

The application of an erasable forms production also permits a completely different printing unit design. Many restraints in printing press design are caused by the necessity of frequent exchange of plates. With this in mind the DICOweb has a completely new design based on the erasable imaging process. In the linear movement concept the cylinders have bearings on both sides, however instead of having bearings built into a sideframe, they are mounted on linear slides. The cylinder bearings are themselves on ball bearings on the slide and are driven by a spindle to move up- and down in a linear fashion. The function of holding the cylinder bearings in position is not taken up by a sideframe, but by the linear slides and a driving spindle. The driving spindle takes up the pressure during the printing process, and there is no bearer contact between the printing and blanket cylinders.

To change the sleeves for blanket and forme cylinders, the operator side bearings can be unlocked and moved away on the linear slides, while the bearing on the drive side stays stationary. During this operation the cylinder is held in position on one side only. Without putting impression on, the strain on the one bearing is not critical. The sleeves can be pulled axially from the cylinder core.

The pressure in the printing nip is adjusted by moving the cylinders on the slides. At any time the pressure can be directly set at the control console and these settings can be reproduced exactly. Very fine increments are possible. Also the thickness of the substrate can be taken into account, meaning that changes of the substrate type or thickness do not need any manual adjustments in the printing unit.

Furthermore, since the distance of the axis of each cylinder in the printing unit is not fixed, the linear movement concept has the capability to change the printing format. This can be achieved by exchanging sleeves with different wall thickness' or by exchanging the cylinders. An exchange of sleeves is relatively easy to perform, as they can be made out of light weight materials, but the maximal wall thickness is limited (to a maximum cutoff 200mm larger than the core cylinder format). The components in the printing unit, which have contact to the forme cylinder during the printing operation have to be positioned according to the position of the axis. This means they have to adapt their position to the circumference of the cylinder. Other components (e.g. the imaging device) can be arranged in a distinct position while the cylinders have to be moved to the corresponding location to have a certain function performed (e.g. imaging). In fact it can be advantageous, to keep different functions spatially apart (e.g. imaging and printing). Additionally it enlarges the space in which components can interact with the cylinder inside the printing unit. Of course additional actuators for the components are needed and the requirements relating to the press control concept are higher.

In the linear movement design the sideframes act more like a framework or suspension for the cylinders, than like a fixed case in the conventional design. The components do not need to be built into the sideframe structure. It is possible to put all components between the frames and have separate connectors to the sides. For example the inking can sit on a horizontal slide and does not need to be integrated into the sideframe. This is the basis for the modular printing unit concept and being able to adapt to different size and processes. It is additionally important for components with short innovation cycles, like the imaging system, where a new and more powerful generation can be integrated relatively easily. (2)

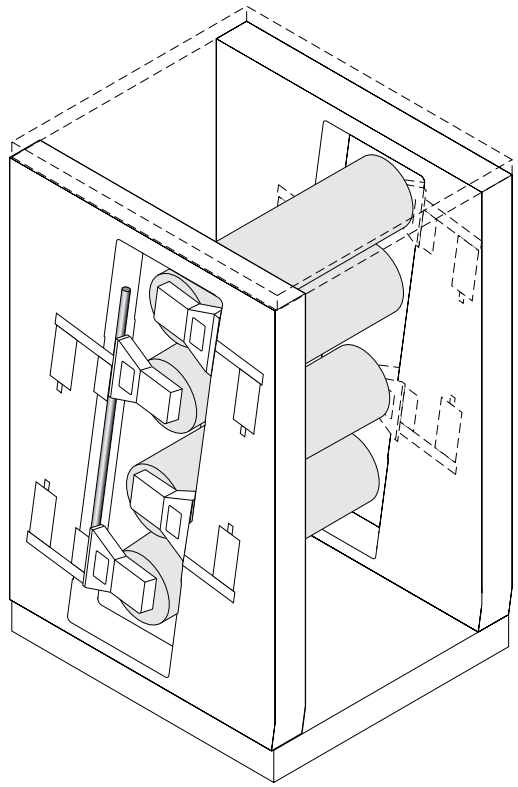

Figure 4: Schematic drawing of linear movement unit design

Trends Towards Media Integration

Workflow

After all automation efforts and digitalization of the pre-press area, the printing and publishing industry realized, that it takes more to create a finished product, than perfectly designed production islands. Single production steps have been automated and put together in one device or into one central control console, but the devices themselves were not connected. Originated in the pre-press area, where digitization and automation had the biggest impact so far, the term workflow originated. First workflow systems handled technical pre-press processes such as layout, imposition, trapping and RIPping and extended later to the pre-adjustment of some press processes as well. Drupa 95 has been abundant with pre-press centered workflow solutions. But especially and with the advent of direct imaging presses, the wider acceptance of non-impact printers and increased automation of traditional presses, the need for complete solutions increased. Decreasing margins and faster turnover times added to that pressure.

Today “solution” is one of the most frequently used words, where, for specific applications, matching hardware and management software is assembled for an overall optimization of the process. Also on the exhibition ground, the trend towards a tighter integration become more apparent. Traditionally, on drupa the different stages of the print production process are presented in different halls. On drupa 2000 two models for process integration have been presented: 1. Under the ownership of one company or 2. as a close, but open cooperation of different manufacturers for each device or piece of software in the production flow.

JDF-Format

A prerequisite for cooperation and a seamless production flow is communication. This in turn requires the existence of some standards. The JDF – Job definition format is a joint effort of four major companies in the graphic arts industry: Adobe, Agfa, Heidelberg and MAN Roland. JDF is a proposal for an extensible, vendor independent job ticket format for end-to-end process management. It covers the whole production flow from page creation to distribution and includes management data. JDF is based on XML to provide the flexibility and extensibility for an evolving communication industry. It is still centered around traditional printing, but is a substantial step towards content driven crossmedia access for printing systems or other hardcopy output devices. (3)

E-commerce

In an industry so much dependent on digital information, the advent of e-commerce in the graphic arts is surprisingly late. After substantial presence on US shows and conferences in the last 12 months, the presentations on drupa have been more discreet. Undoubtedly, electronic job submission and communication has a high potential of saving production cost and avoiding errors is in the production process. But reactions from printers are still mixed and as long as the fear of decreasing margins in a competitive brokering environment is not sorted out, adoption from printer side will be slow.

Even in this area the trend towards integration is evident. E-commerce solution providers start to bring together the functions of data transmission networks, job brokering and transaction management with added capabilities as pre-flighting, remote proofing or job tracking. By providing a collaborative environment, the likelihood of miscommunication decreases and speed of the transactions increases.

Electronic Paper

Although or maybe because it might change the entire printing industry, one presentation happened without being noticed by most attendees of the fair. In a quite restrained manner, Xerox presented two pieces of electronic paper, of which one disappeared during the show.

Xerox's e-paper technology is called Gyricon. It's a rubberized, reflective substance made entirely of microscopic beads that are half black, half white. The Gyricon material is laminated between two sheets of plastic or glass and has the thickness of about four sheets of traditional paper. Before it can be used, Gyricon is filled like a sponge with oil. This creates a cavity for each bead, allowing it to rotate.

When an electronic charge is applied through a computer or wireless radio wave, the beads rotate into place. Some turn black side up, others black side down. A pattern emerges and words appear. Once the beads are in place, they hold their position. The words don't disappear until another electrical charge is applied. Desktop computers, which use liquid crystal displays, or LCDs, require 60 to 70 electrical charges per second to maintain the images on the screen. But Gyricon uses almost no electricity. Unlike desktops, it has no backlight, no hardware behind the screen. Gyricon can receive its electrical charge by being printed from a computer or when a handheld wand is passed over the material like a scanner. According to Xerox, e-paper will be durable, flexible and light. It will come in a variety of sizes - similar to traditional paper.

Together with another company, called E-ink and working on a similar kind of electronic paper, this technology might change the way hardcopy output is produced. Although still far from commercialization, this is a technology to monitor in the future.

Summary

It seems that with drupa 2000 trade shows the cycle of digitalization of the print output became complete, all hybrid technologies are now available in a wide variety of products. User have the choice of the degree of digitalization, up to a fully digital workflow with digital printing or digital imaging in a printing press.

The feeling of insecurity about the future of print among user waned and found its way into a buying rush for new equipment. Many manufacturers found their sales expectation more than exceeded. The fair also proved, that print media are bigger than ever and print will be around us for quite some time. Technological advancements are the engines driving greater topicality, the increased use of color, in daily newspapers, for instance, more customized printed matter, e.g. in the field of direct mailings, and greater economic efficiency. In devising predictions about the viability of print, especially about the role of conventional printing, the progress in print equipment has frequently been underestimated.

Most visible on drupa 2000 was the enlargement of the choice of output devices from conventional to digital printing systems. The trend towards media integration became also more acknowledged. On one side the vertical integration over the whole production flow from content creation to finished product found its way into the “solution” presentations. On the other side, to facilitate horizontal integration, over different types of media, tools for the technical integration became also available to some extent. Undoubtedly both areas have still a high potential for efficiency improvements. Probably the area of production flow support and transaction management software, will be the emphasis of the next drupa.

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3. JDF White paper at: http://www.job-definition-format.org/

Biography

Joseph Schneider was born 1948 in Konnersreuth/ Oberpfalz, Bavaria. He received his university education in Physics at the Technical University in Munich with a concentration on image science, solid-state physics (especially optical storage technologies and physics of high-polymers), optics (especially quantum optics/lasers and integrated optics/waveguides),and physical chemistry. From 1976 to 1980 he was a Scientific Fellow and earning his Doctorate at the Institute for Scientific Photography at the Technical University in Munich. In 1980 he received his Doctorate with the thesis "Growth, decay and spectral characteristics of light-induced absorption centres in silver halide model emulsions" for which he also received the 1981 Research Award (Robert Luther Award) of the Deutsche Gesellschaft für Photographie (German Association for Photography).

From 1980-87 he was with the Fogra Institute in Munich and from 1986-94 Guest Professor for automation at the Institute for Technology and Planning in Printing at the Hochschule der Künste (University) Berlin.

Since 1988 Dr. Schneider has worked for MAN Roland Druckmaschinen AG, Augsburg, building up the Research and Technologies Department and providing technological leadership and contributions to concepts, basic patents and realization of computer-to-press systems for conventional and electronic printing processes. He received the "Innovative Concept Award" of the Seybold Conference 1995, USA for DICOweb Gravure.