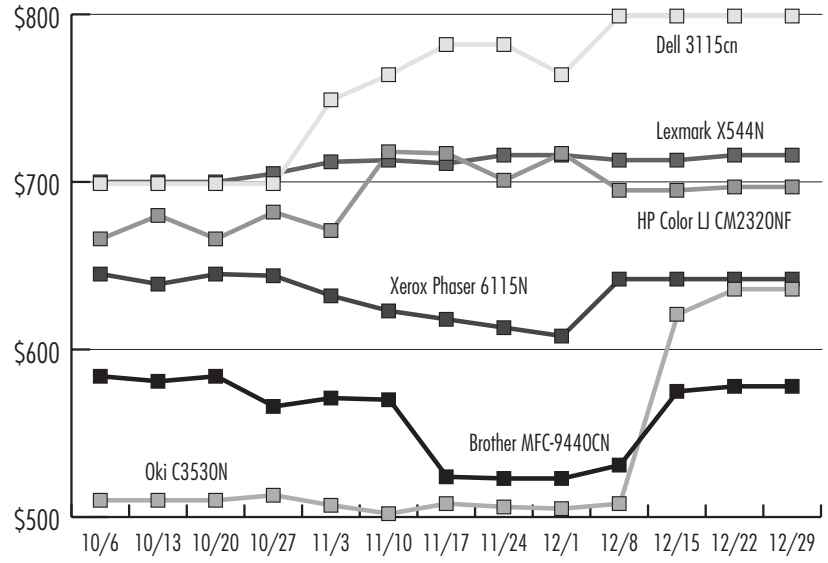
Feet on the Street

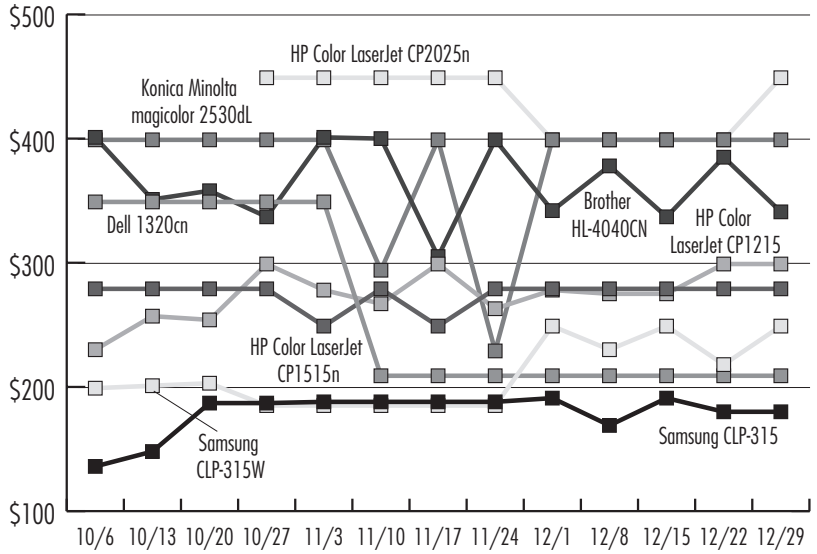
Q4 2008 Post-Rebate Street Pricing

U.S. IT Channel, Sub-$1,000 Color Laser MFPs (base 4-in-1)



Q4 2008 Weighted Average Price After Incentives

U.S. Retail Channel, Sub-$500 Color Laser Printers



Source: Gap Intelligence

For more information, contact Gary Peterson at 858-273-8700 or gpeterson@gapintelligence.com.

Solid State Printing: A New High-Speed Printing Technology

In 2008, all eyes were on drupa and the many continuous ink jet products that vendors had on display *(Observer, 7/08)*. While ink jet ruled the quadrennial show and attendees flocked to demonstrations of HP's Ink Jet Web Press and Kodak's Stream technology, other technologies had their time in the spotlight as well. HP unveiled the Indigo 7000, Kodak displayed the NexPress S3600, and Xerox introduced the iGen4. Clearly the race for leadership in the digital color press market is far from over, as manufacturers jockey for position with various products and technologies.

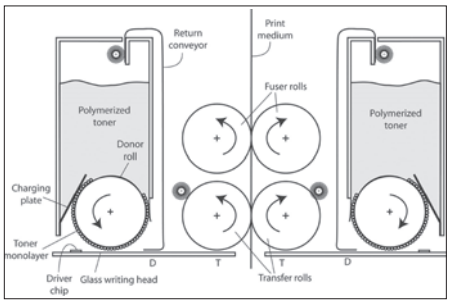
Tucked away in MountainView, CA, however, a little-known digital printing method, called solid state printing, stands in stark contrast to the hoopla surrounding the drupa show. While still some ways out from commercialization, this printing method has the potential to grab the industry's attention, if for no other reason than its unique imaging capabilities: it uses no optical components, laser, or organic photoconductor.

The new technology replaces the traditional laser, photoconductive drum, and scanning system with large-scale integrated circuits

Quick Look

Solid State Sounds Good, Got Any Money to Invest?

- *Solid state technology promises high-speed printing at a much lower cost compared to today's commercial-grade digital presses.*
- *Inventor Peter Salmon is enthusiastic and remarkably nonchalant about the 800-pound gorillas already engaged in this market segment.*
- *Unlike Silverbrook's Memjet technology, Salmon's solid state printing development lacks the very loyal and very rich investors that have helped Memjet approach the brink of commercialization, and without such investors, bringing theory into practice will be difficult.*



Solid state printing uses the power of modern integrated circuits to distribute the imaging function across thousands of imaging channels. A duplex print engine (shown here) is compact, sharing transfer and fuser rolls.

(ICs) and a new imaging technique. In essence, solid state printing employs electrode structures on glass substrates with the electrodes driven by solid-state devices, namely application-specific integrated circuits (ASICs). The electrodes are driven by voltage traveling waves (VTWs) having a 40-volt amplitude. Each pixel site is toned by an independent micro print engine that includes a VTW conveyor separated from its neighbors by barrier electrodes, and each micro print engine images one toner particle at a time, with a mean particle diameter of 10 µm.

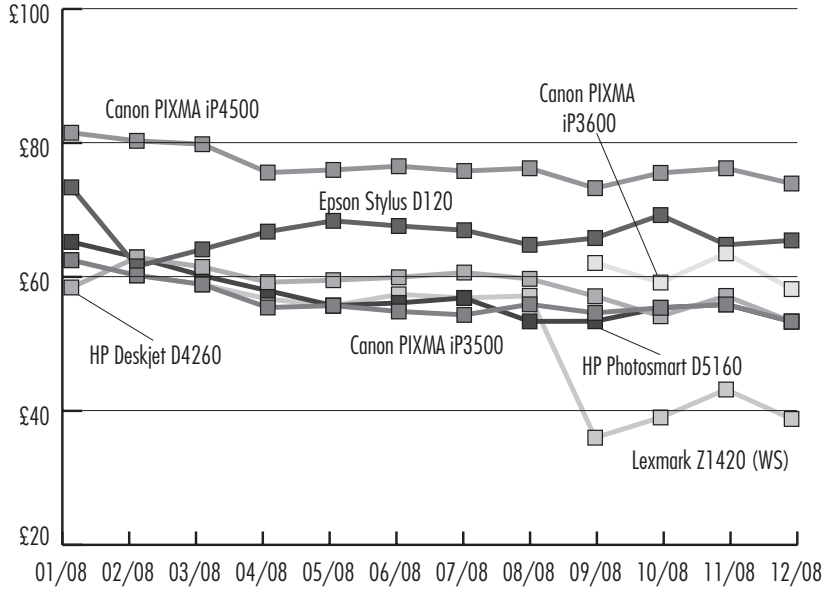
"This new digital printing method involving voltage traveling wave conveyors totally departs from the history of laser writing machines to one that just applies voltages to electrodes and forms the image that way," explains Peter Salmon, vice president of Salmon Technologies, LLC.

Salmon says this new printing concept can provide the speed and resolution of gravure and the variable print capability of laser printing. For example, a device with a 36-inch (914 mm) print width would consist of 86,400 writing channels per head, with each channel including a 10.6-µm wide particle conveyer (micro print engine) and a pixel modulation rate of 96 KHz, that could produce 2,400 × 2,400 dpi output at a continuous web speed of 200 feet per minute (fpm). The raw imaging capability of this machine would be 16.6 gigapixels per second in duplex mode, an unprecedented rate for printing on demand, asserts Salmon.

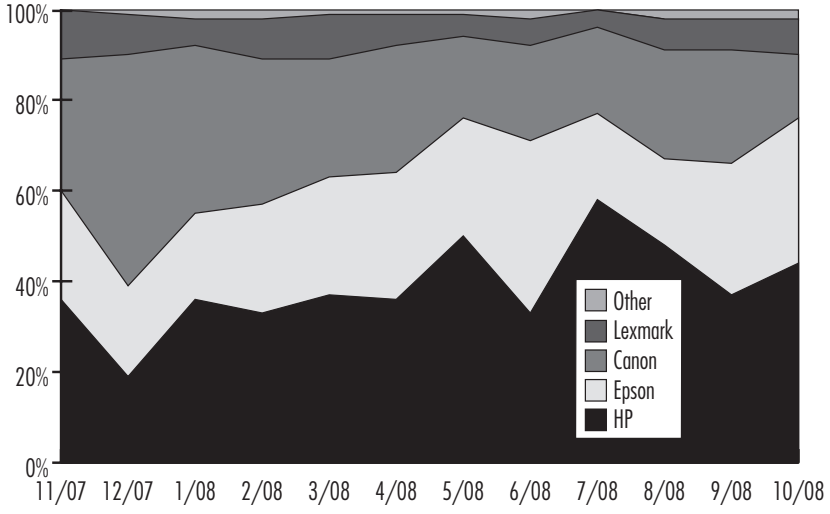
And the cost of such a device, according to Salmon would be a fraction of the cost of a traditional laser imaging system *(see table on page 6)*. "The printing power of the arrangement derives from the processing ca-

European Channel Checker

U.K. Street Price Trends: 17–24 ppm Color Ink Jet Printers



U.K. Market-Share Trends: 16–30 ppm Color Ink Jet Printers



Source: Context

For more information on Context research and analysis, please go to http://www.contextworld.

pability of the custom driver chips, together with direct-imaging print algorithms," maintains Salmon.

The proposed new printing architecture can offer high performance in a compact size (approximately 16 square feet of floor space for a CMYK printer without finishing options) with a simple and direct paper path. The toner path begins with a monolayer of charged particles uniformly distributed on a rotating donor roll. The charged particles are uniformly transferred to VTW conveyors on the glass writing head, creating a fully toned mass of particles moving over the writing head surface.

Each channel of particles streams by a diverter electrode at location D *(see image on page 5)*. According to the digital print algorithm, as each particle passes by the diverter electrode it will be ejected or allowed to pass through, thereby forming the digital image. Ejected particles are returned to the toner hopper using the return conveyor.

Salmon claims that using a separate diverter electrode for each individual toner particle is a more robust imaging method than diverting packets containing multiple toner particles because the diverter electrode is centered and directly coupled to the particle. Imaged toner then streams to location T where it transfers to the first transfer roll. Subsequently the imaged toner is transferred to the print medium at the transfer nip and fused in the fusing nip.

The figure on page 5 shows a duplex version of the monochrome print engine that provides simultaneous printing on both sides of the print medium, which Salmon says produces excellent registration and doubles the printing speed to 400 fpm. He adds that the technology can accommodate a wide range of media types and thicknesses because the transfer and fuser rolls have large diameters and compliant surfaces.

Solid State Manufacturing Costs

Item	Description	#/head	Cost	Per head	Per chan.
Patterned glass substrate	monochrome writing head, 38 x 12 inches	1	$400.00	$400	0.46¢
Driver chip	custom ASIC w/1,024 outputs, 18 x 18 mm	85	$20.00	$1,700	1.97¢
Assembly and test	flip chip on glass (FCOG), re-workable	85	$1.00	$85	0.10¢
Totals				$2,185	2.53¢

Based on information from Salmon Technologies, LLC

Salmon reveals that the technology has been tested with chemical toner, which performs well in this imaging process because of its uniform size distribution and the ability to create spherically shaped toner particles.

All is not rosy, however, as Salmon admits there are challenges remaining before solid state printing can be brought to market.

First, the technology must be able to achieve a good image transfer from the writing head to a roller or belt at high speed. According to Salmon, this transfer is primarily enabled by a precise gap between the writing head and the roller or belt, as image quality depends directly on having a small and consistent gap. He explains that a run out error in the first transfer roll can make this transfer difficult, and Salmon believes that a proprietary lapping technique will help overcome this problem.

Second, he is concerned about potential durability issues relating to toner that may be recycled through the printer multiple times. "Spherical toner particles formed by polymerization are intrinsically rugged. However, fine surface agents may become embedded while the toner is worked, and this may lead to variations in tribo-properties," explains Salmon.

Our View

The graphics or commercial printing market holds enormous appeal to printer manufacturers, as this is where the vast majority of pages are printed. The announcements made at this year's drupa underscore the intensity with which vendors are going after this market segment. And far from being deterred by the new machines introduced earlier this year, Salmon maintains that the activity in this market segment is "very encouraging." When asked how a product using solid state technology compares to a device like HP's Ink Jet Web press, Salmon believes that solid state printing avoids some of the inherent disadvantages of ink jet. "With ink jet a fluid carrier must be eliminated after the image is formed; this may require substantial energy to drive off the solvent and may create noxious fumes. Also the ink jet nozzles may become blocked," he speculates. "Finally, special paper treatments are normally required to achieve the best image quality."

At the same time, Salmon says that HP's digital Web press will benefit his development efforts, as the same finishing modules "could equally well be applied to a press of our type." Moreover, he believes that announcements such as the HP Ink Jet Web press could drive other manufacturers to seek other options.

"Someone that is intimidated by this announcement by HP, now has access to an alternative technology that is potentially better," claims Salmon. "It is within our grasp to create a printer having extraordinary capabilities and low cost of ownership," he adds. "We have a good chance to produce the quality and speed of gravure while processing variable data. The printing device will be much more compact than existing machines and may have much improved reliability."

Salmon Technologies is currently seeking to partner with a company to move this technology to the next phase, and Salmon says the next step could "work a lot of different ways." For example, his firm can reform a technology team, then build and test the critical elements, including the transfer characteristics. Or Salmon Technologies can transfer the existing patents and a pending patent and take on a consulting role.

For more information, Peter Salmon can be reached at (650) 814-1076 or at peter@salmontech.com.

Financial Reports

	Period*	Revenue	Net Income
Adobe Systems	Q4 2008	$915.3M	$245.9M
	Q4 2007	$911.2M	$222.2M
	FY2008	$3.6B	$871.8M
	FY2007	$3.2B	$723.8M

*period ending 11/28/2008

Comments: In the fourth quarter of fiscal 2008, Adobe achieved record revenue of $915.3 million, compared to $911.2 million reported for the fourth quarter of fiscal 2007. GAAP operating income was $273.2 million in the fourth quarter of fiscal 2008, compared to $275.8 million in the fourth quarter of fiscal 2007 and $219.5 million in the third quarter of fiscal 2008. "Despite a difficult economic environment in 2008, we were able to achieve record revenue and double digit growth for the sixth consecutive year," said Shantanu Narayen, president and CEO.