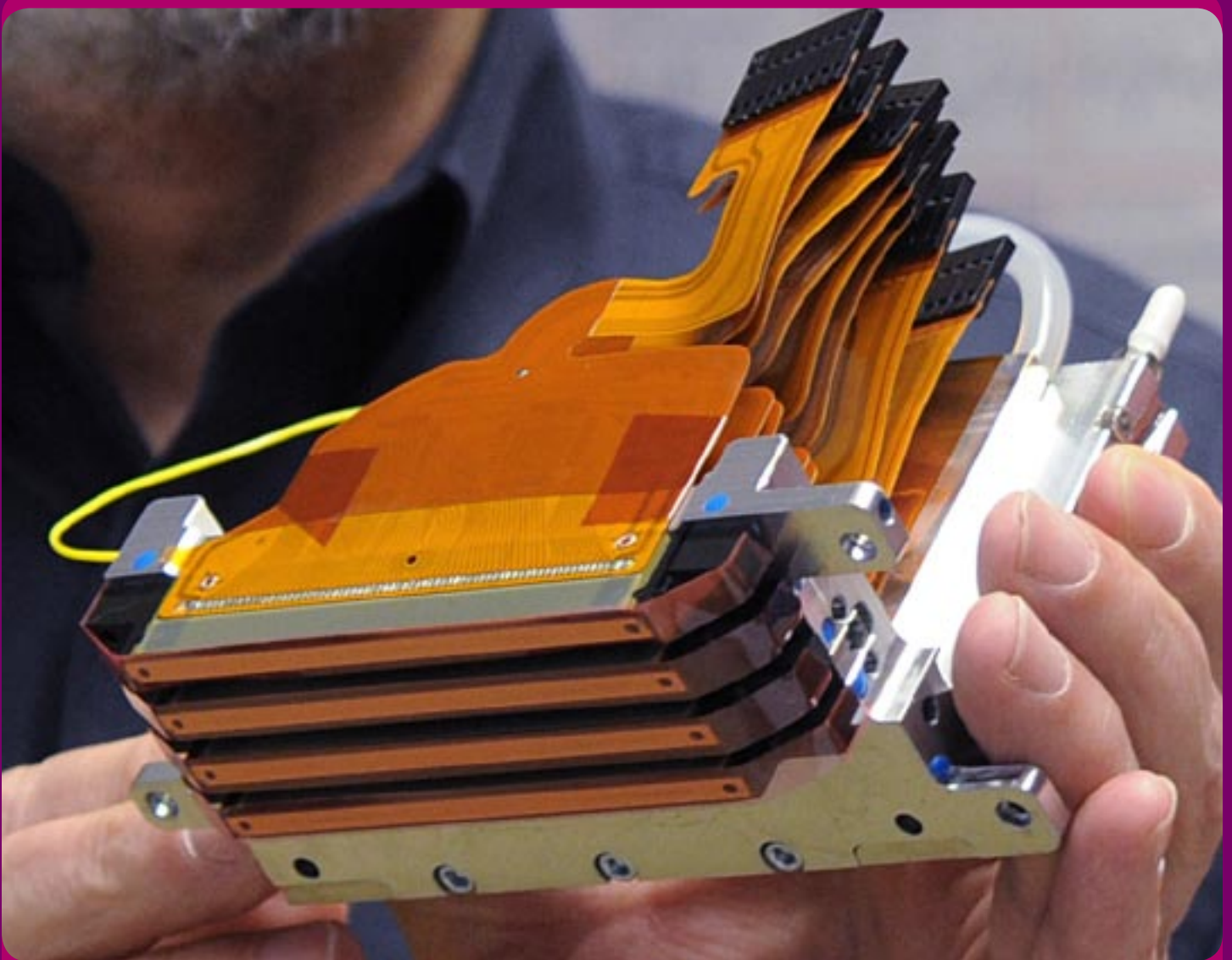
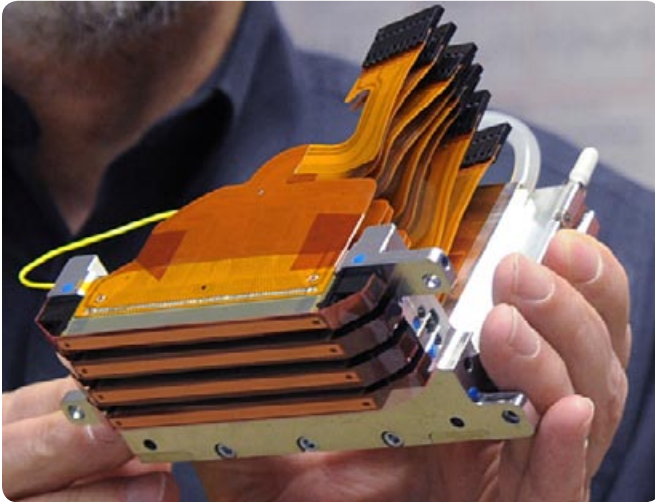


# Tips, Info, Help, Documentation on Piezo Printheads



Used in UV-Cured Inkjet Printers



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## Introduction

As print shop owners, print room managers, and printer operators become more savvy, they begin asking questions about which printheads are best for jetting UV-curable ink. Then they ask about UV-curing lamps. And naturally end-users wish to learn more about UV-cured ink, both the chemistry and the curing.

Since FLAAR is at a university, and since the FLAAR staff are lab personnel, professors, and/or graduate students, writing about technical matters is part of our basic program. And for a non-profit institute, providing public education is part of our mandate (we just need to obtain enough income to keep our basic costs covered).

So beginning in autumn 2005 we decided to publish tips, help and essential basic information on all aspects of UV-cured inkjet printing technology. This follows our work all during summer 2005, which resulted in over 40 new publications on UV-cured inkjet printers. FLAAR has been studying UV-cured inkjet printing technology since spending a week at DRUPA 2000 where the Durst Rho 160 prototype was first exhibited and another week at Photokina 2000. We have invested more hours in learning about UV-cured inkjet printers during 2001, 2002, 2003, and more intensely from DRUPA 2004 through countless trade shows and conferences in 2005 and now during 2007. This report has been updated in 2008 and 2010.

We discuss printheads without delving into patents or excruciatingly technical digressions. If you are an end-user, you mainly need to understand the basic differences between the different brands of printheads.

And, most importantly, it is essential to recognize that Chinese printer manufacturers make a big effort to emphasize which printheads they use. Chinese printer makers have learned that some end-users are wary of Xaar heads, so now the Chinese wave Spectra, Konica, and even Toshiba Tec heads in front of prospective buyers of their printers.

But be wary that it takes a lot more than a good printhead to make a printer function. Even quarter-million dollar Chinese printers, with Spectra heads, still have issues: not from the heads, but from everything else in the printer that is made in China. These parts wear out, break off, or come unscrewed because the threads on the nuts and bolts fall off.

This FLAAR Report does not attempt to classify printheads by whether they are shared-wall, or top-shooters, or anything of that overly technical nature. FLAAR Reports are to assist end-users to understand practical aspects of different brand names. A report on printhead innards is something we are interested in, but this should be a separate report. with research funding to facilitate the necessary drawings and animations needed to show all the technical aspects.

### A Glossary to help understand the Jargon

We provide a separate glossary on UV-cured inkjet technology if you wish assistance to understand the jargon. All our publications on UV-curable inkjet printers are readily available on [www.wide-format-printers.NET](http://www.wide-format-printers.NET), in the link on UV (the column of links is on the right side of the page).

### UV Printhead

According to the Ink Guide institute (2009) the UV Printhead is the most important part of the Inkjet printer, and it has the function of transporting the ink from the printer to the material through holes called nozzles, also frequently called jets. The number of nozzles can change depending on the manufacturer and model of the printhead.

Hanson (2010) explains that nozzles can be as small as 10 micrometers in diameter, equivalent to 1/10 of the diameter of a human hair.

### **Drop size: Effect in quality and speed.**

The unit used to measure an inkjet drop is the picoliter (pl).

The Toshiba Tec CA4 printheads can produce print drops as small as 6pl and printheads like Spectra can produce drops from 10pl to 80pl.

In general, the smaller the drops, the better the quality achieved in print. However, smaller drop sizes can reduce the speed of a printhead system. Likewise, printheads that produce bigger drop sizes do not offer the same print quality, but their print speed tends to be better.

## **Thermal printheads**

Burke (2007) explains that thermal printheads use heat for the formation and delivery of the ink drop.

A thermal printhead heats the ink in a fraction of a second. The heat generates a bubble of vapor that triggers the ejection of the ink.

Hanson explains that the heat created by the heater boils a thin layer of ink, which generates a bubble of vapor in the ink. This bubble, produces an increase in the volume of the ink layer of approximately thousand times. This increase in the volume creates a pressure pulse of the fluid, causing the ink to be ejected.

Burke lists the process of ink expulsion with a thermal printhead:

- a) When the heater is activated, it warms the ink causing the bubble of vapor to expand. This pushes the ink out of the nozzle.
- b) After the heater is deactivated, the compartment is filled again with ink.
- c) The compartment is then ready to be shot again.

In most thermal printheads, the ink in the nozzles that is not expelled is suctioned into the heater with a considerable force, which tends to wear out the printhead trough time.

As defined in the FLAAR Glossary for UV Printers, the nozzle plate is a thin metal plate in which the small holes are drilled. This plate is delicate and when a head crashes into a rigid material, the nozzles openings can be damaged. To protect the nozzle plate from head strikes most nozzle plates are recessed.

Burke warns that most of the printheads that use a separate nozzle plate integrated to the circuit silicon run the risk of the formation of fluid passages in between. A better design implies nozzles that are drilled directly in the printhead.

## **Piezoelectric Printheads**

Hanson explains that this technology is based in crystal film which has the property of deformation when an electric field is passed through them. This type of printheads is designed so that the crystal materials deform one of the walls of the ink channel which end up in each nozzle.

When the voltage is applied to the film it expands. When the crystal material is adapted to the pump chamber connected to each nozzle, this expansion allows the entrance of ink to the pump chamber. When the reaction of expansion ends the ink is pressured and jetted out the nozzle.

### **MEMS (Micro-Electro-Mechanical-System) Printheads**

MEMS technology can be related to nanotechnology because the dimensions handled range from one micrometer (a millionth of a meter) to one millimeter. Burton explains that this printheads also use the same principal as the thermal printheads: the ejection of drops trough heat.

Due to the sizes that can be handled with this microscopic technology, one of the advantages of MEMS is the larger and dense groups of nozzles, which rises the resolution and print speed.

Another advantage is the possibility of one-pass printing.

However, note that two renowned printers, the EFI Rastek T600UV and the InkTec Jetrix, started using Spectra M-Class printheads, with a similar techonology of the MEMS. And after a month both UV printers changed the printheads. MEMS technology has had difficulties to be fully implemented.

### **Agfa-Xaar printheads in UV printers**

Agfa has sunk millions of dollars into Xaar during 2005, attempting to get into wide-format printing. Xaar has many of the crucial patents; just that the actual original Xaar printheads had a high failure rate in earlier years. We hope the new Agfa version of the Xaar heads overcome past problems. The Agfa-Xaar heads are used in the new Agfa Anapurna, the Mutoh Cobra 100, and the M Press from Thieme. The Agfa and Mutoh printers are identical except for the color. The M Press is totally different.

The Xaar version of the Agfa-funded head appears to be the Xaar OmniDot 760, the GS8 version. The first printers that attempted to use the Agfa version of this head (especially 2005-2006) seem to have had issues. But the Xaar OminDot 760 now appears to work successfully in the Teckwin TeckStorm UV dedicated flatbed printer. The same printhead is also in the new Mutoh Zephyr printer (since summer 2008). So it is curious why Agfa itself had such problems in 2005. But today (2008) the successor to the Agfa Anapurna 100, the :Anapurna XLS, prints beautifully. So the three years of R&D between FESPA Munich 2005 and DRUPA 2008 has good results. Since Agfa is not itself a printhead manufacturer, the problems with the original Agfa-designed systems between 2005 and 2007 are a good example of how a printer distributor should not try to enter technology for which it is not really prepared.



*The XAAR 760 was one of the several printhead models exhibited in the company's booth at FESPA Amsterdam '09.*

Both the Agfa-Xaar head and the Toshiba Tec head use grayscale technology. Indeed Agfa uses a modified Toshiba Tec head in its Dotrix printer. Do not confuse this with grayscale meaning black-and-white. Grayscale means multiple droplets, of various sizes, being jetted to form a single “dot.” Individual droplets can be 8 picoliters, which is a major breakthrough for industrial printheads. Most Spectra heads offer 50 or 80 picoliters. Hitachi-Ricoh heads offer 30 pL. The newer generation of Spectra heads offer much better drop size than before, 30 pL and below. Since 2007, Spectra will also offer a grayscale technology, with very small droplet size.

One issue with a new printhead technology is what will be printhead life, and printhead replacement cost. These factors will become better known as the product itself is available for testing. Currently the Agfa-Mutoh printer exists only in alpha stage; going into beta stage. This printer development stalled during late 2005 and all 2006, and had to be replaced with a Korean printer using Spectra heads!

There are several issues affecting all printheads. Its “normal predicted life” is impacted by

1. How badly the nozzles are worn out by constant flushing.
2. How well, or poorly, the nozzle plate holds up to head strikes.
3. How well, or poorly, the nozzle plate holds up to being wiped during cleaning.

So the normal predicted life may be meaningless if either constant flushing or frequent head strikes cause premature failure.

These factors affect all heads, not just Agfa or Xaar.

Xaar has survived due to infusions of money from Agfa (estimated at about 5 million per year), from Chinese manufacturers during 2003-2005, and from license fees from Konica, Toshiba Tec, and Seiko.



*XAAR offices in Shanghai, China. In 2009 FLAAR attended APPPEXPO and visited several wide-format printer manufacturers. XAAR is a popular brand among entry level printers.*

## Brother printheads

It is generally believed that it was a Brother printhead in the infamous Kodak 5260 water-based printer, the most expensive printer-launch failure in its time (potentially more costly than the CrystalJet). How much of the millions of dollars in lost launch costs were a result of the printhead will probably never be known (Kodak did not have much experience developing printers in those years (2000-2001) and Brother was making printheads for postage meters, hardly a high-resolution application).

Second-hand sources indicated that Brother had little interest or incentive in that year to improving any printhead for wide-format inkjet applications.

Although Kodak never learned from this debacle (they kept trying to sell this dodo bird for two years, completely oblivious to the fact that the could not function adequately), it now appears that Brother profited from the fact that it's first child was either defective or at lease deficient. Now, since at least 2008, Brother has a new printhead, approximately four inches wide.

However no wide-format printer manufacturer that I have spoken with has expressed any interest in Brother printheads. The mainstream manufacturers seem interested primarily in Spectra, KonicaMinolta, and to some degree with Toshiba Tec and Xaar; a few are interested in Ricoh, but not many.

## Epson printheads in UV printers

Zünd attempted to make a UV printer with Epson printheads. This prototype of the Zünd XY-Flat was shown at DRUPA 2004, but disappeared quickly thereafter.

Eastech offered a model with Epson printheads about that same year; but I have not seen that printer recently. Eastech states that they have been able to get Epson printheads to function, but I am not familiar with any installations of an Epson-based UV printer in the US or Europe. During 2007, I found two companies that had the older Epson heads (of 2006) jerry-rigged to use UV-cured ink. But these were only in test labs: not in real printers.

All this would suggest that this generation of Epson printheads are not a good solution for handling UV inks. This raises the question of what printhead will Roland attempt to utilize in its UV-cured flatbed printer? The Roland UV-printer continues to be delayed. I am curious if whether trying to use Epson printheads is one cause for the delays.

Since late 2007, the newer generation of Epson printheads has been certified by Epson as being able to accept UV-cured ink. Several UV printer manufactures are testing this ink. So far Epson puts so many restrictions on the use of it's heads for reserving different markets, that no UV printer is stating publicly that it will use these heads. Another downside is that Epson heads have a reputation for being low-end.

As of late 2009 I have not seen or heard of any printer manufacturer serious considering Epson printheads for UV printers. And I have not seen or heard of the Epson printhead division seriously approaching the major large-format printer manufacturers. With Seiko heads, however, here there is occasional usage, such as by VUTEk.

### Hitachi (Ricoh) printheads in UV printers

ColorSpan 72UVR and at least one Teckwin UV printer are two of the few printers that utilize Hitachi (Ricoh) printheads in its UV printer. ColorSpan and Teckwin (Matan) also use Hitachi heads in their solvent ink printers. The quality of ColorSpan Gator (solvent ink) and the ColorSpan UVX flatbed are admirable, so the Hitachi printhead appears to be an acceptable choice.

There is one other major UV-curable inkjet printer manufacturer who is testing Ricoh heads, which indicates that these heads have benefits. A lot of the information that FLAAR receives I feel should remain confidential, so we defer from listing the printer manufacturer until he publicly switches from their current heads to Ricoh (if they decide to do so). But it is definitely worth noting that there is more to Ricoh printheads than people realize.

About the only thing we found was an IMI news release that says Hitachi has a 96-channel E1 printhead and a 128-nozzle E2 printhead.

Printhead Generation	Total nozzles	Nozzles per inch	Firing frequency	
GEN 1	32	19	10 kHz	
GEN2	48	19	10	
GEN3	384	50	20	
GEN3 E1	96	38	20	
GEN3 E2	128	75	30	HP Scitex TURBOjet
GEN3 E3	192	75	30	Matan, ColorSpan UV
GEN4	384		30	Gandinovations flatbed

(some data from IMI conference)

The lack of information is in part because Hitachi printhead division (Hitachi Printing Solutions) was purchased by Ricoh. The company is now Ricoh Printing Systems.

If you would like to read more about Ricoh printheads, there is an informative article by Mark Elsbernd, Vice President, Ricoh Printing Systems America, Inc., in a recent IMI conference (2005). Otherwise, whereas it is easy to find all the information on Spectra and Xaar printheads, the same is not true for Hitachi printheads. Even a search on Google.com was not fruitful. Nor was a search on the Hitachi website either. Same under Ricoh; not much information whatsoever on their printheads. So not much information is forthcoming on the two drop sizes of their E3 model Ricoh printhead.

The Matan dedicated roll-to-roll UV printers use the Ricoh E3 printheads. Also, one other new UV-curable printer will also the E3 Ricoh heads but by far the majority of recent UV printers use Spectra or KonicaMinolta printheads. A few use Toshiba Tec heads.

Ricoh	
Ricoh	
Hitachi Koki	Scitex Vision TURBOjet
Hitachi E3	Matan Barak 3, Barak 5





*Matan Barak roll-to-roll printer at FESPA '09. This is one of the UV printers that uses Ricoh heads.*



*Gandinnovations Jeti 1224 Nano Jet II at ISA'09. The Jeti printers have traditionally used Spectra heads, but this newer model uses Ricoh heads to produce a higher quality.*

Gandinnovations made a lot of noise about using Ricoh printheads, but some industry analysts have suggested this was mainly to make Spectra nervous. It is estimated that Dimatix was potentially owed huge amounts of unpaid invoices during the years that Gandinnovations made profit by not paying distributors in full.

The major problem with Ricoh printheads was the debacle with the ColorSpan 5440uv series of printers. The printhead seems to have had pinched nozzles in the middle row. Another issue was that you could not use the printheads and then ship the printer with these same printheads.

Only ColorSpan and HP know the millions of dollars that were lost due in part to these defective printheads. Finally the entire HP Designjet entry-level series was discretely phased out. One distributor said he found the printers so trouble-prone that he dumped two unsold models into a dumpster.

The ColorSpan 9840uv evidently utilized a different generation Ricoh printhead. I have not heard of systematic issues with that Ricoh head.

### KonicaMinolta printheads in UV printers

At DRUPA 2000, Photokina 2000, and at other trade shows in Europe in 2000 and 2001, Konica showed its Iguazu proofing printer (water-based ink; not UV-cured). They had great hopes for this printer; PR releases stated they hoped for sales of up to 10,000 machines.

This printer never made it; was never even offered in the US. The beautiful Konica Iguazu failed to launch in the US. Despite tons of money, and predictions of Konica that it would sell tens of thousands of units, this printer suffered the same fate as the legendary CrystalJet, Kodak 5260, Oce Arizona 60UV, and all the retrofitted Tiara printers.

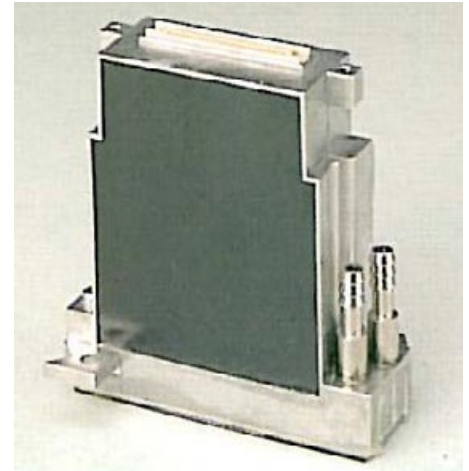
The natural question is, to what degree was the Konica head at fault?

Azero, a US distributor of printers from Hypernics in Korea, tried to sell their Azero CreonJet 8250 printer in 2003-2004. This printer never left beta-stage in the US. The natural question is, to what degree was the Konica head at fault? In this case it may simply have been that Azero ran out of operating or R&D capital. In other words, the printhead itself could have functioned just fine.

Then printers from Hypernics were sold into Eastern Europe by Azon. Neither Azon nor Hypernics exhibit at trade shows in the US or even in Western Europe, so we can't judge their products any further. Recently Hypernics itself seems to have gone out of business; at least their website is off the air.

But then Konica kept working on improving their printhead, and today the Konica-Minolta piezo printhead is highly regarded. Indeed the impressive print quality of the IP&I Cube UV printers is due to their use of Konica-Minolta printheads. Any product, with enough investment capital, and moxie, can improve. As a result, the Konica printheads today in 2007 are definitely better than those of 2000-2003.

Seiko does not publicly identify the printheads used in its solvent ink printer, but it is widely considered they are from Konica (they are definitely not from Seiko itself). The heads used in the ColorPainter 64S are okay, but fail



*The Konica Minolta KM512 printhead comes in two versions, the KM512 MN for oil or solvent ink, and the KM512 MH for UV ink. The difference is that the latter is equipped with an internal heater for UV ink. Photograph courtesy of Konica Minolta.*

prematurely in some instances, especially when using an early batch of light cyan and light magenta inks. But this appears to be a problem in that batch of ink, and not just the head. If you constantly have to flush the ink, this wears out the jets and nozzle plates.

Today the same Seiko printer is sold as the HP Designjet 9000s. The ink problems have been resolved (especially since the HP ink is slightly different than that offered by Seiko originally).

Recently an industry colleague mentioned that “Konica would like to manufacture their own printers too.” I vaguely remember that circa 2000-2001 there was a Konica wide-format inkjet printer, offered as a printer for proofing. It was exhibited at several international trade shows but was never actually offered for sale in the US.

At DRUPA 2008 there was a prototype KonicaMinolta printer using cationic UV ink and LED curing lamps. There are increasing comments that the cationic ink causes rapid deterioration of the insides of the printheads.



*Konica printer at DRUPA 2000*



*Konica Minolta KMIJ-X UV printer at DRUPA '08. This prototype came with CMYK inks and cured with LED lamps.*



*Konica IGUAZU 1044SD printer at CeBIT 2001*



Early KonicaMinolta	Azero CreonJet UV8250F (Hypernics)	
KonicaMinolta	GCC StellarJet 183UVK	
KonicaMinolta 512	Sun NEO UV-LED Evolution	14 pl
KonicaMinolta	GCC StellarJet K100UV	14 pl
KonicaMinolta 512	Docan 2512, Docan 2518	14 pl

During 2009 KonicaMinolta printheads continued to be selected as more printer manufacturers either switched from Xaar or Spectra. They might switch from Xaar for reasons of reliability; they might switch from Spectra to get lower price.

**These are some of the current models using Konica Minolta printheads:**



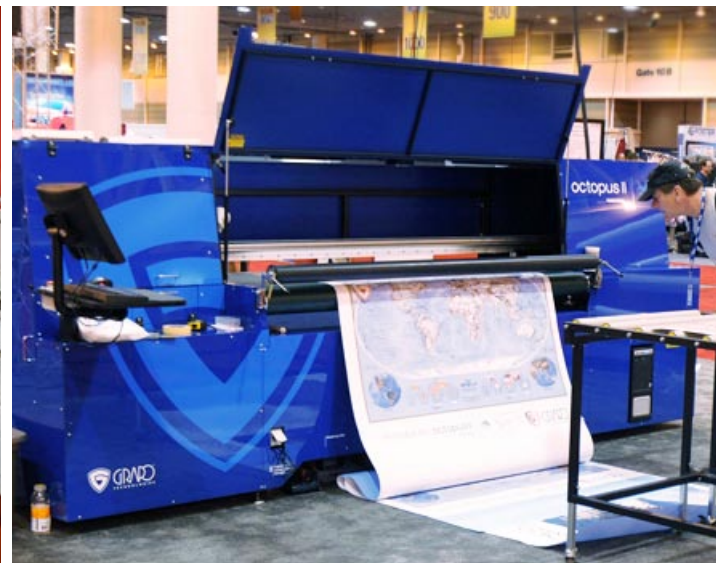
*Dilli Neo Titan UV combo printer at ISA '09.*



*GCC StellarJET 183UVK hybrid printer at FESPA '09.*



*SwissQprint Oryx dual structure UV printer at FESPA '09.*



*Grapo Octopus II KM8/720UV combo printer at SGIA'09. In some cases you can tell which printers use Konica Minolta heads by the integration of the "K" or "KM" letters in the name. This is also the case of the GCC StellarJET models.*

### Kyocera printheads

These KJ4 heads are considered not for general use (not yet). Plus many printhead companies demand that printer manufacturers buy expensive testing units even to try their heads for the first time. So most printer manufacturers are not willing to pay such a fee up front, especially since the heads are not well known.

What Kyocera is after is print-pass width (over 10 centimeters which is over 4 inches) and speed.

Brother and Kyocera developed a low energy head which consumes only 1/14 of the current piezo head. They are also targeting the line head for the fast offset and copier application. The print speed of this line head is higher than 800mm per a second.

Hopefully any features of the former Brother printheads that Kyocera may be using are not still carrying the defects that caused the collapse of the Kodak inkjet division. The printhead in the ill-fated 5240 printer is reportedly from Brother (2001).

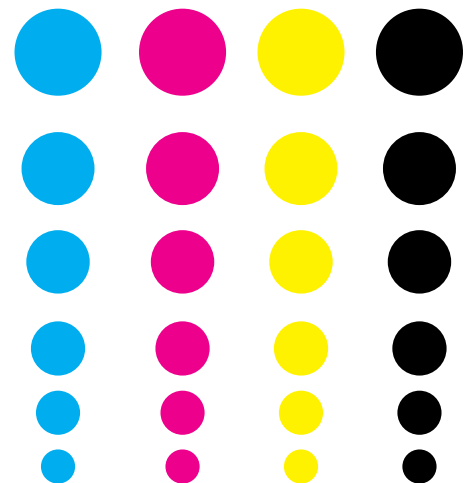
Kyocera has the unfortunate reputation of demanding too much money for its printhead testing unit. So other than one or two models in 2009, not many wide-format printers are using anything from Kyocera.

### Gray-scale Printhead Technology

Xaar is the company that has developed grey-scale technology the furthest. Toshiba Tec is the first printhead manufacturer to produce heads with the Xaar license that produced consistently good output (though light banding in some dark solid colors is still an issue).

Now KonicaMinolta and other companies have also successfully licensed the grey-scale technology. Grey-scale printhead technology has nothing to do with grayscale imaging with Adobe Photoshop. The Xaar website, IMI conference reports, and Google search for “grey-scale printhead” or “Gray-scale printhead” will keep you reading for hours or days.

Printer manufacturers that use these printheads to achieve impressive quality with small text fonts don't want to let their competitors know which printheads they use, so the printer manufacturers don't list the printheads by brand name or model. But just about everyone knows that Mimaki uses Toshiba Tec heads. Now Oce is playing the same game. If they are not also Toshiba Tec my guess would be that the Oce Arizona 250 is using Konica KM512 heads. Once you buy the printer you will find out sooner or later, and usually FLAAR finds out sooner or later even before: it's Toshiba Tec.



*With grayscale technology, a dot is created by several drops of different sizes. In this example, the printhead has a 6-level grayscale, which means 6 sizes of ink drops.*

## Panasonic

Panasonic and Brother offer printheads about which very little information is available outside Japan. Panasonic is manufacturing a large line head, with the length of 500mm, combining 30 pieces of each head. True 600 dpi, 3 picoliter. The cost is extremely high, much more than US\$10,000 per piece, maybe \$20,000. I am not sure but maybe, Dainippon Screen is using it and making the big on-demand printer to output the invoices of internet sales companies, telephone company, etc. They use oil-based ink.

Japanese manufacturers such as Kyocera, Panasonic, and Ricoh are not targeting the high volume and low cost head since that area has so many competitors and they have no room to enter newly from now. So, their target is the high-end electro photo imaging and document printing machine market. Panasonic who was seriously looking for a new application of such an expensive head.

At ISA 2009 no one even mentioned Panasonic printheads. At VISCOM Italy '09 someone mentioned that Panasonic printheads were being used in the Impika printer. However these are now already over two years old.

## Ricoh printheads (See Hitachi)

## Samsung

Hopefully there will be more information available on Samsung printheads in 2010. You can find information on their MEMS printhead experimentations as far back as 2003. But so far, no manufacturer has been able to make MEMS printheads hold up to full time production use. At no trade show during 2009 did anyone even mention Samsung printheads.

The MEMS heads of PixDro, bought by Scitex Vision and thus now owned by HP Scitex, have issues very similar to the problems of the M Class MEMS heads of Spectra. These issues are discussed later in this report. Thus I am skeptical of any other MEMS heads being successful (if they are, I would need to see this in person in a factory and demo room).

## Seiko, their new printheads in UV printers

Seiko is a successful company, but their first Seiko version of the Xaar printhead circa 2000-2003 was not successful. The Seiko printhead shown at DRUPA 2000 and used in the Seiko oil-based printer resulted in quality so poor that this printer won the "Worst in Show" award. Three years later the printer quality had improved noticeably, but still was inadequate. As a result of unrealistic advertising claims and low quality, this oil-based printer failed in the marketplace.

Tiara attempted to retrofit a Seiko printer to accept Lyson inks. Tiara went bankrupt or otherwise went out of business in early 2005 (though probably for many other reasons than using a Seiko printhead).

When Seiko itself produced its own solvent printer (seemingly manufactured by Mutoh), Seiko did not use its own head; it uses another brand, reportedly a Konica head.

The first and only company that I am aware of that has attempted to use a Seiko printhead in a UV printer is the PIT Sprint II, made in Bulgaria, sold in Spain by Printing & Imaging Technologies, S.L., [www.printing-imagingtech.com](http://www.printing-imagingtech.com). The manufacturer of this printer is DM, Digital Machines, a company related to SIVAR. Both are in Bulgaria. SIVAR manufactures screen printing and related equipment.

The PIT machine was not actually printing at FESPA 2005 so there is no way to judge whether the Seiko printheads are functional, nor of what quality.

If the DuPont Aristri textile printer uses Seiko printheads, this is about the first successful use of these heads that I am familiar with. But this is not UV-cured ink technology. Unfortunately DuPont is getting out of the printer business (as of late 2007). It is worth asking if the use of Seiko heads has any impact on the failure of the DuPont textile printer (one problem, unrelated to the heads, was that an end-user in Canada told me that this printer needed two operators, one on each side).

But, like other printheads, including those of Xaar itself, Seiko printheads gradually get better. Seiko printheads today are light years more advanced than the same

brand of printhead in 2000-2003 (for Seiko oil-based printers). So soon you may be seeing more printers using Seiko printheads. Since 2007, the Vutek QS2000 and QS3200 have been using Seiko printheads (since late 2006). As soon as funding is available we will undertake site-visit case studies to learn more about how these heads hold up. The Roland AJ-1000 solvent ink printer also uses a Seiko printhead.

There is plenty of user-friendly information about Seiko printheads on the web site of their distributor for the US, [www.Triteck.com](http://www.Triteck.com).

So far our information sources suggest that “Seiko heads must stop and spit” This wastes time and ink; potentially you could end up spitting 160 liters of ink waste per year. Multiple this by the average cost of UV ink and that’s a huge expense for the printshop. So if you are using a VUTEk QS printer, better ask another printshop that has this printer about this added expense.

Another person said that “Seiko heads must be close to the material,” as though if not close enough the drops will be errant.

*EFI VUTEk GS5000r at ISA'09. The EFI VUTEk are perhaps the only UV-curable models currently using Seiko heads.*



Seiko		Unacceptable quality
Seiko		Better, but still poor quality
Seiko		
Seiko	VUTEk QS 2000 VUTEk QS 3200 VUTEk QS 3200r	Acceptable quality but reportedly require constant flushing which wastes thousands of dollars worth of UV ink and/or flush liquid.

It is probable that Seiko printheads are also used in the newer VUTEk GS series of printers. Otherwise, not really many printhead manufacturers are using these heads other than one or two Chinese printer manufacturers.

### Spectra printheads in UV printers

Aellora used Spectra printheads and achieves impressive quality.

The RP-720UV uses Spectra SE-128 heads in their 6-color printer and Spectra SM-128 heads in their dual CMYK printer. This Raster Printers machine produces admirable quality for an entry-level printer.

Dilli (D.G.I.) UV printers use Spectra Nova heads, but unclear in their spec sheets whether the Spectra Nova 256/80 AAA or 256/50. When you go to the Spectra website, to try to get the actual specs, you find out there are two “Nova 256/80 AAA heads”, the PH 256 and JA 256. We will assume it is the PH version. By 2006 you could upgrade to Spectra Galaxy heads in Dilli UV printers. Unfortunately, the Agfa/Mutoh OEM of the Dilli NeoPlus printers use only the Nova printhead version. The downside is a larger dot size, so output quality is grainy and not as photo-realistic as it would be if a better printhead had been selected.

The Flora 2200-series (2214) uses Spectra Nova 256. It is unclear whether the heads are Nova PH 256/80AAA or Nova JA 256/80 AAA. The DuPont ChromaPrint 22UV version of this same printer uses Spectra Galaxy 256 heads for the color and Spectra Nova heads for the white ink.

The Flora LJII 1800 UV printer shown at FESPA 2005, the prototype for the RP-720UV printer, uses Spectra 128 heads. But like all Chinese printers, you can get whatever heads you want.

The original Gandinnovations JETi UV printer uses Spectra SL-128 heads. The newer 1200 dpi<sup>1</sup> Gandy printers use a Spectra head with smaller droplet size.

Inca printers started with Xaar heads but quickly moved to using Spectra heads. Inca printers are sold by Sericol.

The Zünd 250 uses Spectra heads but its incomplete spec sheets do not provide any information on what model head. This is the first instance of problems with Spectra heads, but it could also have been an issue with the ink. This printer was withdrawn from the market recently, and will need another six months further beta testing and modifications before it is re-launched later in 2006.



Spectra printheads in Gandinnovations JETi UV

<sup>1</sup> The printheads are not 1200 dpi; this dpi is achieved by software and by multiple passes.





*Spectra printhead in Raster Printers*

The earlier Zünd 215 series uses Xaar heads; there was lots of premature failure of these Xaar heads on early Zünd 215 printers, but most of these issues have been resolved since 2003.

VUTEk is not very informative in some of their spec sheets about which printheads they use but when you ask you learn they use Spectra, until the new QS Series of VUTEK printers: these switched to Seiko heads. So today, with pressure from Konica, Toshiba Tec, and Seiko, the competition is not really between Xaar vs Spectra has it was five years ago, but Xaar-licensees vs Spectra.

Spectra Printing was a division of Dimatix. You could obtain information on their printheads from [www.dimatix.com/divisions/piezoelectric-print-heads/printheads.asp](http://www.dimatix.com/divisions/piezoelectric-print-heads/printheads.asp). Since 2006 Spectra printheads are owned by Fujifilm. The company is FUJIFILM Dimatix, Inc, a wholly owned subsidiary of FUJIFILM Corporation. Officially the print-heads are no longer called Spectra but this brand name is so well known that not many people use the new designation.

From this page you can download PDFs on each printhead. The problem is that virtually no printer manufacturer tells you what printhead model they use. They say "Spectra" without telling you whether it is Spectra Galaxy or Spectra Nova.



*Spectra printheads in Gandinnovations JETi UV printer*

Spectra	Anhui Liyu Eureka	256 nozzles
Spectra	Anhui Liyu Eureka	128 nozzles

Spectra Nova	Augend RF20	256 nozzles
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Spectra S	Augend RF20	128 nozzles
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If a printer spec sheet indicate the head is a Spectra Galaxy, they don't usually tell you whether it is a model JA 256/30 LQ or PH 256/30 HM.

Spectra Galaxy	Dilli Neo Jupiter	30 pl
Spectra Galaxy	Flora F 25 UV	
Spectra Galaxy	LexJet Legend H72UV	50 pl

Spectra SQ	Gandinnovations Jeti 1224 UV NanoJet flatbed	15 pl
Spectra Q class	InkTec Jetrix	
Spectra		

Spectra M Class	Raster Printers Daytona T600UV
Spectra M Class	Rastek T1000
Spectra M Class	L&P Virtu HD8
Spectra M Class	Yuhan-Kimberly Keundo textile
Spectra M Class	InkTec Jetrix

The Spectra MEMS heads are one reason for the fine quality of the Daytona T600UV, but for more complicated systems, you need to check to see if there is a lowering of the ink density after the system is turned on. The MEMS heads in the complex Virtu HD8 may have an issue with the first and last nozzle. This is why it helps to be able to visit the printhead manufacturing facilities, demo room, or headquarters so we can learn what work-arounds are available for issues (since all printheads have one issue or another).

At SGIA 2008 Spectra M Class MEMS technology heads were used in the

- Rastek T1000,
- InkTec Jetrix UV flatbed,
- and Yuhan-Kimberly VU:1800 textile printer (not UV cured).

But both Rastek and InkTec are removing the M Class heads and replacing them with other non-MEMS heads. InkTec is switching to Q Class and Rastek is switching to Toshiba Tec.

The L&P Virtu HD8 was not exhibited at SGIA '08 because L&P was in meltdown before its remnants were purchased by a Swiss company. But not even the Swiss have a magic wand powerful enough to rescue the HD8 project.

Since it finally turned out that MEMS technology is not working adequately for most printer manufacturers, all UV printers that attempted to use them were pulled from the market, causing millions of dollars in lost time. EFI Rastek stopped using Spectra all together and switched to Toshiba Tec. L&P went out of business. Yuhan-Kimberly's project with Keundo is unlikely to continue. And InkTec has not shown their Jetrix at any trade show outside Korea since starting with MEMS class heads. It is assumed InkTec will exhibit at FESPA, with a different printhead.

A newer generation of Spectra printheads offers a 10 picoliter drop size. This is a major advance over 80 or even 50 or 30 picoliter drop sizes of the previous generation. This printhead is so new it is not yet used in many UV-curable inkjet printers.

### Durst version of Spectra printheads in their UV printers

Durst now makes their own printhead arrays, using Spectra SM class nozzle plates. The result is a four-pack array, a patented, trademarked Quadro array. In effect this is four Spectra SM 128 nozzle plates bunched together. So this is not a Durst head; it's a Spectra head re-arranged by Durst.

### Inca array of Spectra printheads

When you have a head failure on some Inca printers, a replacement array costs about \$25,000. Ouch.

### Toshiba Tec printheads in UV printers

Mimaki declines to identify what printheads it uses in its UJF-605C or UJV-110 printers. Trying to hide technical information is not fruitful, since once you buy the printer you will find out sooner or later. And if you are paying \$100,000 for a printer, you ought to have the right to know, in advance, what you are getting for your money. Besides, it is unclear whether it is proper to hide the information for what is inside a product; you would need to check European and American laws.

But all this is immaterial, because sooner or later people find out. Indeed all you have to do is attend an IMI conference and you quickly see lists of which UV printers have which printheads. The source for Mimaki printers is listed as Toshiba Tec.

A similar printhead is used in the factory. My notes indicate Toshiba Tec. The factory was purchased by Agfa from Dotrix who bought it from Barco. This atypical inkjet printer is interesting technology but has not yet caught on. Its silly original name was part of the problem. Now the printer has a more mature name, simply the Agfa :Dotrix. At Print '05 I found the Agfa :Dotrix the most intriguing inkjet technology at the entire trade show.

The highest quality output of any UV printer (especially for text) are the Oce Arizona 250 GT and the Mimaki flatbed printers that use Toshiba Tec printheads. However reportedly the newest Mimaki flatbed, the IPF-1326



*Dr. Hellmuth holds a Quadro Array system based on Spectra printheads at the Durst factory in Lienz, Austria.*

(first presented at ISA 2006 in a back room; at at IPEX 2006 in the Mimaki booth) uses a head other than Toshiba Tec. You hear this misinformation because Mimaki has a policy of not identifying its heads. But most sources say clearly that the Mimaki JF-1610 and JF-1631 use a new generation Toshiba Tec printhead.

The Toshiba Tec heads offer a minimum drop size of 6 picoliters. Now you can see why the Oce, Mimaki and Agfa :Dotrix printers have such fine image quality. But of course there is more than droplet size to result in good image quality. Banding can still be an issue no matter how good the drops themselves are. Also, Oce claims that because of their grayscale printheads they don't need 6 colors; Oce claims that 4 colors is enough. This is not substantiated by print samples in the Oce booth.

Oce uses the version CA3, same printhead as the Mimaki JF-1631. This has seven levels of droplet size from 6 to 42 picoliters.

But the other printers have the CA4 version of the Toshiba Tec head

- Dainippon Screen Truepress 650 (a \$600,000+ printer)
- Lotte InnoJet UV900
- Flora F1 180 UV

This has a droplet size 6 pl to 90 pl.

Both Screen UV printers probably have the CA 4 version, but this is not confirmed.

Toshiba Tec ?	Agfa :Dotrix, original version	
Toshiba Tec CA3		6 to 42 pl
Toshiba Tec CA3	Mimaki JF-1631	
Toshiba Tec CA3	Oce Arizona 200	
Toshiba Tec	Screen Truepress jet2500UV	
Toshiba Tec	Rastek T1000	
Toshiba Tec	Hanky FB-500, SGIA '08	
Toshiba Tec CA4	Oce Arizona 250GT, 350GT, 350XT	6 to 90 pl
Toshiba Tec CA4	Screen Truepress 650	
Toshiba Tec CA4	Lotte InnoJet UV900	
Toshiba Tec CA4	Flora F1 180 UV	
Toshiba Tec CA4	Raster Printers Daytona H700UV	
Toshiba Tec CA4	Mimaki UJV-160uv	
Toshiba Tec CA4	Current version of Agfa Dotrix	



*The Mimaki JFX-1631 is replacing the JF-1631 printer. This new model uses LED lamps, but it continues to use Toshiba Tec heads.*

Most Mimaki printers use the old Toshiba Tec head; since the Mimaki UJV is new, I am estimating it is using the newer head.

If so, then the printhead used in the Mimaki UJV is the same head as used in the latest model of Agfa Dotrix printer.

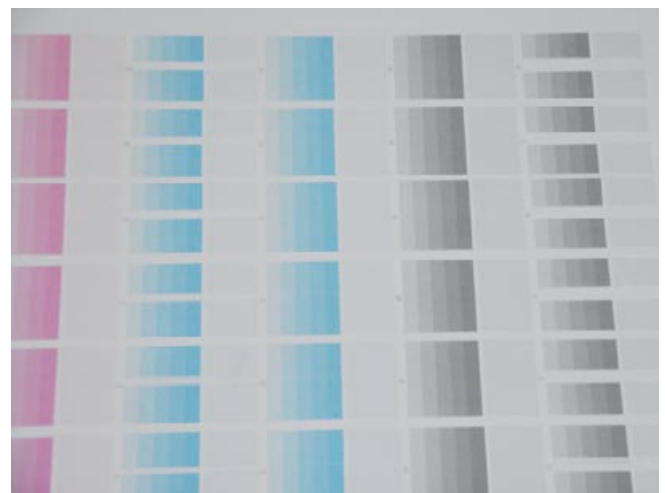
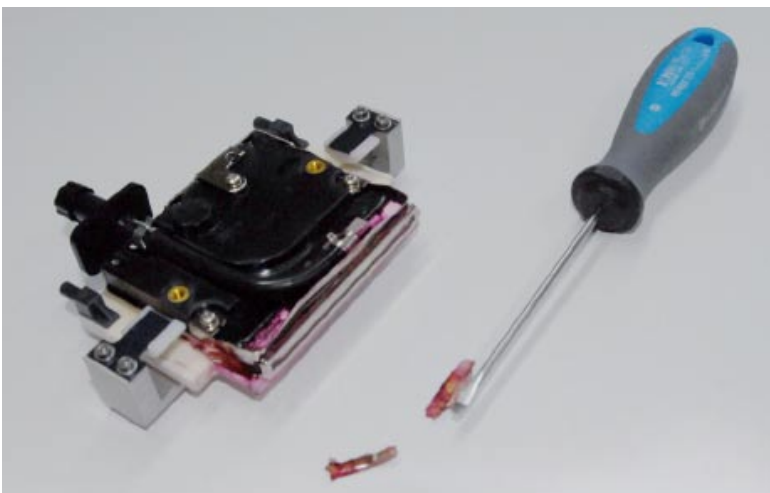
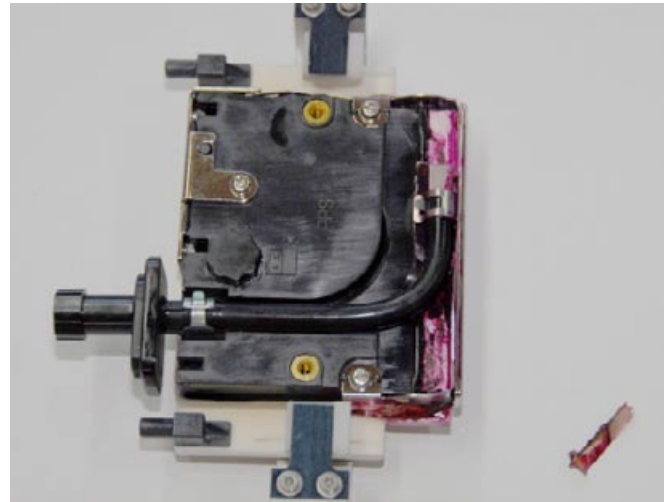
Sometimes the printhead used for one brand of printer may have a different name than the identical printhead used for another printer.

### Purging problems with Toshiba Tec Heads? A printhead issue or a printer problem?

The Mimaki JF-1631 and JF-1610 have been plagued with small issues since the printer was launched in 2006. Although no one issue was itself large enough to cause the printer to be useless, the sum total of issues has continued (despite attempts to fix things). In other words, once you have the basic engineering design and chassis, trying to fix bits and pieces does not always work.

Here is a comment by the owner of a Mimaki JF-1610. He wished to buy a second UV printer (not so much just to replace the first one, but mainly to simply have more capacity. The owner has requested that his name not be listed.

- Clogged Heads/Nozzles – we're finding this to be a continuous and frustrating problem. We spend a lot of time manually cleaning the clogged heads and also cleaning by using the machine ink cartridges. It seems that at any one point in time there are clogged nozzles. The printer operator will do a time consuming cleaning which will relieve the clogs he intended but then when he runs the test when he finishes and finds other nozzles just became clogged.
- Very often we cannot clean the clogs manually or with the machine and he has to make a service call for a completely new nozzle to be installed. If you check our records, we have a ton of service calls already and we have had a lot of nozzles replaced. We even had a situation where the guys came out to install a new nozzle and the new nozzle didn't work right out of the package and we had to wait another day.
  - What can be done about this constant clogging situation? Is it an ink issue, a nozzle issue, etc? Can we do something to make this better?
  - And, whenever we have a service call, the guys use up to one full set of ink cartridges just to fix it and you know how expensive that is. Also, what will happen when our warrantee runs out? This could be incredibly expensive to fix and I don't think it is any fault of ours, these nozzles or ink or something are just not performing as they should. Is this a common problem for Mimaki? Are they working to fix it?



- UV Lamp – we only run one lamp at a time and we run the machine every day for 8-10 hours a day. We had a lamp fail at exactly 500 hours which is what it is warranted for so we had to buy a new one. You know how expensive those lamps are. Is this what we should expect? To spend that kind of money maybe every 10 weeks? Are the lamps designed to fail so fast? Can we get Mimaki to improve on this?
- The small little rubber wipers – The operator says we also need to replace these once every week or two weeks. They used to cost \$5 and now cost \$38 apiece. They are smaller than a penny. The cost is really ridiculous. Can we get some relief here? Is there a solution so we can buy inexpensive wipers?

Anyways, we really love the machine when it works as intended, and we were close to buying a second one. However, it can't be that Mimaki expects its customers to endure these issues for the life of the machines. There must be something they can fix in the manufacture or something. Maybe we are doing something wrong but I don't think so. Your technicians (Mimaki teks) have been here and so ... they know how we run the machine. I think we may be one of the few customers running the machine all day every day as intended. Can you guys help us so I can free up my production manager from spending all his days when the machine (is quirky) and also so we can run the machine at a minimal cost as we thought would happen when we made the purchase.

My open question is, to what degree is this an issue with Toshiba Tec printheads?

And to what degree is this an issue with Mimaki

- Ink delivery system
- The brand of ink used by Mimaki
- The use of wipers to wipe the printheads
- Other possible issues in the mechanics by the Mimaki engineers

And to what degree are these problems a result of the engineers simply using old Epson-printhead related features from their years of using Epson heads for first water-based inks and then solvent-based inks? Too many features of this printer are the result of a decade of past use of Epson printheads. Just look at the silly Epson-style cartridges for the inks.

Look at the miniscule LCD screen, the same you get on an Epson, HP, or Canon water-based printer still today.

And they are even still using stepper motors: even Teckwin stopped using stepper motors already a year ago.

I am not an engineer nor an ink chemist, but my educated guess would be that the problems of this Mimaki printer are largely because the same engineers are making each new printer using old features left over from past years of success with water-based and then solvent ink: conservative and traditional, however, turned out to be the Achilles Heel in this printer.

The result was the lowest sale of any major dedicated flatbed printer in the world: the only flatbed printer with lower sales is the Inca Spyder 150, and that is due to its high price and small bed size.

I would also point out that most printer manufacturers today are sure NOT to use wiper blades on their printheads (too much chance for damaging the nozzle plates).

And although the main cause of the poor overall performance of the Mimaki JF-series UV flatbeds is conservative engineers using old components from past successes, I would also highly suspect that the Toshiba Tec printhead is to some degree liable as well. But this can best be checked by seeing if the Oce Arizona 250 (which uses the same heads) has similar problems. If the issues are primarily on the Mimaki, and not on any other printer with the same heads, then this rather clearly points to where the problems originated.

## Other Problems with Toshiba Tec printheads

A printer company south of Ljubljana had almost endless problems with disintegration of the Toshiba Tec printheads in their Océ Arizona 250 GT after a new ink pump was installed. But even before this, they had constant drop out of nozzles.

They reported the same problem that Mimaki owners report: you waste time cleaning up one nozzle. You start printing again and another nozzle fails...

Naturally the manufacturer and distributor blames this on the end-user. So why do they make and sell a printer that has this kind of defect in a typical printshop? Yes, most problems of most printers are a combination of end-user issues but if you look more closely there is also a defect with the printer. ColorSpan suggested that most of the issues with their 5440uv were end-user problems (since most buyers of that entry-level printer did not have much experience with a UV system). But by August and September 2008, there were enough people within the distributors who were themselves fully aware that the issues were in the printer, not in the end-user.

But true, you need a constant humidity, a dust-free environment, etc. Yet this does not explain why 7 printheads fail after a new pump is installed. Nothing else has changed in the printshop environment.

Moral of the story is that every printhead has pros and cons: the benefits of the Toshiba Tec heads are fine quality in photographs and text. The downside is the amount of time, and ink, and patience, lost with trying to purge out clogged nozzles. To put it mildly, these printheads seem a bit finicky.

## To what degree are some of the Toshiba Tec printhead problems caused by overheating?

Printer manufacturers blame most problems on the end-user. Seldom does a printer manufacturer admit that their choice of printhead is at fault.

But it could be more than the printhead; what if the associated electronics and cooling system (or lack of cooling system) is resulting in overheating?

What if the engineering surrounding the printheads is simply not robust enough to print all day and night without overheating the printheads?

So even when it is the printhead that disintegrates, the cause (or part of the cause) can also be in the printer itself (so not entirely the fault of the printhead).

This said, however, if a printhead can't survive real-world use, then perhaps there are other brands or models which are more robust.

**Xaar printheads in UV printers**

Xaar has survived in the world of UV primarily from infusions of millions of dollars from Agfa, as well as smaller sales to Gerber, GRAPO, and many Chinese manufacturers. Otherwise Xaar heads are not popular for most brands outside China.

The roll-to-roll Gerber Solara uses the Xaar model XJ 126 heads. The newer Gerber model UV2 also uses the same printheads.

Early versions of the Grapo Octopus used the Xaar XJ 500 printhead. Grapo is in the Czech Republic; their printers are sold primarily in Europe (by bedigital, Barcelona). GRAPO currently uses KonicaMinolta printheads.

The Infiniti UV printers sold by Infiniti Europe use Xaar XJ-126 Series 300 printheads. Infiniti printers are distributed by Fei Yeung Union Digital Technology of China.

The Oce Arizona 60UV used Xaar printheads. This printer failed to produce adequate color, adequate surface finish (too matte), or even acceptable overall performance (too slow).

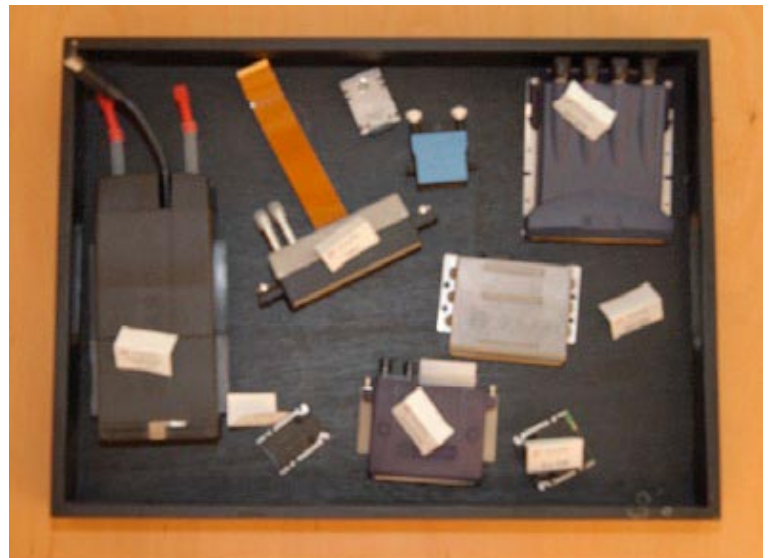
The Oce Arizona 220UV used Xaar printheads. The quality is good, better than expected considering its printheads. But the printer is slow, and is not selling well. Oce currently uses Toshiba Tec printheads in the newer Oce Arizona 250 GT UV-printer.

Yishan, a little known Chinese manufacturer, uses the Xaar XJ500-360 UV printheads in printers sold by Yishan and by Digirex in Turkey. The version in Turkey is called the TechnoJet Flat UV, and was displayed at FESPA 2005, and other shows in Turkey and Europe.

In general, circa 1998-2000 the very early UV printers started with Xaar heads. But virtually all the more sophisticated manufacturers quickly abandoned trying Xaar heads and switched to Spectra. Since 2007 several UV flatbed printer manufacturers began using heads from KonicaMinolta.



*Xaar booth at ISA 2007*



*Xaar Printheads*

Xaar provides specs head by head but I have not yet found one table that compares them all.



Xaar but model uncertain	Sky Air-Ship flatbed printer
Xaar but model uncertain	Oce Arizona 220UV
Xaar but model uncertain	Oce Arizona 60UV
Xaar but model uncertain	I believe the Scitex Vision VEEjet used Xaar heads at one time

Xaar XJ-126	Gerber Solara UV2	Very slow
Xaar XJ-126	Infiniti hybrid UV printers	
Xaar		

Xaar 500	
Xaar XJ500	Grapo Octopus, early version
Xaar XJ500-360	Yishan TechnoJet Flat UV

### Xaar 760 Omni-Dot

This head reportedly requires a special USB port and air-cooling does not work, so prefers water-cooling. But water-cooling is covered by patents held by other companies. Teckwin and a few other printers are experimenting with the Xaar 760 printhead.

This Xaar 760 Omni-Dot printhead is used in two or three new UV-curable printers such as the Teckwin TeckStorm flatbed and the Mutoh Zephyr hybrid.

Xaar 760 Omni-Dot	Teckwin TeckStorm	
Xaar 760 Omni-Dot	Mutoh Zephyr	8, 16, 24, 32, 40 pl
Xaar 760 Omni-Dot	Grapo	
Xaar 760 Omni-Dot	Agfa :Anapurna XLS	
Xaar 760 Omni-Dot	more to come	

Note: FLAAR covers only wide-format uses; not narrow format label printers.

### Xaar 1001, HSS

One printer manufacturer said that this head “jets so much ink that the UV-curing lamps have to be high powered to cure so much ink. The result is that the lamps are too hot.”

			Native resolution
Xaar 1001, HSS	Meital 3000-10 flatbed	Variable droplet down to 6 pL	360 nozzles per inch
Xaar 1001, HSS	INX (Triangle) Evolve UV	Test lab printer with LED curing lamps, shown at DRUPA 2008.	
Xaar 1001	One Solution, Vega	To be launched at FESPA 09	
Xaar 1001	Hi-jet digital, dedicated flatbed	New, made in China	

## **Xaar printheads have significantly improved by 2008**

Mutoh would never select a printhead that had defects or problems. Their selection of the Xaar 760 documents how far Xaar has come in improving their quality. The Agfa :Anapurna XLS is a second example. The Teckwin TeckStorm is the third example.

## **Epson Printheads**

Epson printheads available from 2007 onward can handle UV ink. Previous Epson printheads had trouble handling the heaters/heating that UV ink required. Labs were able to make the year 2006 Epson printheads work with UV ink but not much outside the lab was commercially successful. Eastech claimed to be able to run UV ink through Epson heads but I do not know a single installation of this model in the US or Western Europe.

Epson has restrictive policies on who is allowed to use their heads. For example, Roland, Mimaki, and Mutoh are not allowed to feature Epson heads in water-based printers for giclee or photography. Epson wants this market for itself.

Now (since 2007), Epson wants the indoor signage market for itself, and is trying to unseat the market position of Roland, Mimaki, and Mutoh in the use of water-based printers in these applications. For 2008 Epson intends to introduce a new solvent-based 64" printer to attempt to take over the signage market from the established players.

Now for 2008 it will be interesting to see if any inkjet printer manufacture dares to sign up with Epson, knowing that once any non-Epson company becomes successful, Epson may later restrict use of its heads in precisely that successful application.

## **Panasonic printheads**

The most recent addition to the family of printheads are those from Panasonic. These were not a factor in wide-format inkjet of past years but nowadays (2008) I hear of Panasonic heads whenever I ask about new developments in inkjet printers, especially when the topic of discussion is page-array concepts. The Impika 600 press is usually mentioned in this regard.

## Atypical Printheads (seldom seen or used)

### Kyocera printheads

Kyocera makes both thermal and piezo printheads (KJ4, for example). It is rumored third hand, that Roland has been experimenting with Kyocera heads, since UV ink did not work well with previous generation Epson heads (2005-2006 before the new generation Epson heads did accept UV ink).

Rarely does anyone discuss or even mention Kyocera printheads in the world of wide-format inkjet printing. But a lot will change after DRUPA 2008.

### PicoJet

This was an energetic company that worked hard for years. But a combination of being clobbered by wealthy competitors and hit with technological issues, PicoJet has not yet had their printheads used in a full-scale wide-format UV-curable inkjet printer.

PicoJet tried to get their printheads used with a prototype printhead made by DTL, but that printer manufacture announced a UV printer before it was finished, and offered it at a price that could not be realistic. DTL disappeared and this was the last time PicoJet had an opportunity.

It is unclear whether PicoJet has survived the economic downturn.

### Xerox-Tektronix

Tektronix developed the use of solid clumps of ink in the previous decade. The ink became known as “hockey pucks.” Seven or eight years ago Mutoh used these heads in a hot-melt wide-format printer. The chemistry was a failure for most applications. The few applications for which it was acceptable were not enough to survive. So this printer model, and its entire ink chemistry, was seldom tried in any wide format printer since then.

Today Xerox-Tektronix printheads are poorly known in the world of UV wide-format printers. But clever printer manufacturers are always on the lookout for either really cheap printheads or heads with some specific feature that they need. Since page-array printers need several hundred printheads, it is logical that a manufacturer will seek the absolute cheapest printhead out there. So VUTEk selected the Tektronix head circa 2007-2008 to attempt to build a page-array flatbed to compete with Inca and with the HP Scitex FB7500. Unfortunately, if no other wide-format printer manufacturer anywhere in the world is using Tektronix printheads, this is a good indication that perhaps they have features that, well, maybe don't work.

Thus it is hardly surprising that the VUTEk DS printer at DRUPA 2008 had no printheads actually installed. The printing was simulated (the bed went back and forth but the image had been pre-printed; the prototype machine sent to DRUPA was not capable of actually printing). Yes, the prototype back home in Meredith was able to print, but after showing this to journalists and PR people (in other words FLAAR was not there, since we are not a PR agency nor do we intend to be a trade magazine), the entire project was “postponed.” A polite way for indicating that Tektronix heads don't work. Third-hand comments suggest that VUTEk tried with a better brand of head (one would estimate Seiko) but the entire project ran out of money.

## MEMS Printheads

### MEMS technology Printheads from Scitex Vision

The new HP Scitex X2 printhead has a drop size of 50 pL which will not set any records for rendering small text. So these printheads will need other beneficial features to compete with the impressive resolution of the KonicaMinolta, Toshiba Tec and Seiko printheads. These features are the fact that the printhead is very slim, so can be packaged together to form an array. In fact one HP Scitex printer uses over 120 of these heads.

Now you know one reason why HP bought Scitex Vision.

### Who really makes the X2 printheads? Are they really HP Scitex printheads?

When I first read all the PR releases I assumed that the X2 printhead was originally developed by Scitex Vision. After all, this is what all the PR blitz claims. But gradually I am learning about a company named PixDro because one industry source said the heads are reportedly actually originally from PixDro.

PixDro offers a MEMS printhead with 128 nozzles.

The question is, what is the relationship between the X2 printhead and the PixDro PL 128 printhead? The X2 printhead itself is no longer shown on the PixDro web site: HP Scitex owns all rights to this head, and it will not be available to any other manufacturer.

Here are a few of my initial questions about the X2 heads. I ask these questions primarily because the advertising claims vary from unlikely to untrue. If the information were more truthful at the beginning it would not be necessary to ask questions.

- Which company developed the X2 printhead originally?
- Who owns this company?
- Who owns the patents?
- Can anyone else buy these same or similar heads on the open market if HP is not sole owner of PixDro?
- For, say, a manufacturing run of 1000 heads, how many of these 1000 heads can actually be used?
- For an XL2200 printer, if it has 120 (or 128?) heads, what is the failure rate per week?
- What is the cause of the failure in manufacturing?
- What is the nature of the failures during use? Clogging or other malfunction?
- What is the warranty period when you buy the printer (the portion for head replacement)?
- What is cost for an extended warranty that includes replacing printheads?
- What is the cost per head when the warranty is finished?
- How many prints are ruined when a head fails in the middle of a job?
- How much time is lost every time you have to stop the print run and replace a head?
- If there is such constant loss of printheads, does this mean you can't print unattended?

Apparently the failure rate of the X2 heads is 100% by the fourth month. My mathematics is rudimentary, but my mental calculations suggest this is one printhead that fails per day. Now you know why HP bought NUR: it had no roll-fed UV printer for DRUPA and no longer any UV flatbed that functioned adequately (because all the new printers that were announced in Barcelona in September 2006 were all depending on the X2 printhead).

So the problem of MEMS heads is that they are not yet proven: there is no track record for manufacturing these heads. The technology is so new that no one knows what the actual results in the real world will be. But the same was true with many innovative products. So in a year MEMS heads will potentially be increasingly popular. But so far they are still in beta stage.

Although it is probable that X2 printhead reliability problems and X2 failure rates are the main cause of its continued delay of HP Scitex printers, it is worth asking out loud what other issues may be causing the over 1 year non-appearance of this printer.

Curiously, at SGIA 2008 HP launched a prototype of the HP Scitex FB7500 with X2 MEMS heads, 312 of them ! Hopefully the X2 heads work better today in 2009 than they did at SGIA '07. However it is noteworthy that the main spec sheet for the FB7500 specifically warns you that changing printheads is a common task.

It is also sad to hear back from printshop owners who have witnessed the FB7500 at work: unanimously they say that the quality is not very impressive.

Since HP bought ColorSpan in autumn 2007, it will be interesting to see whose printheads they use in the next generation UV printers: Ricoh (currently used by ColorSpan) or whether HP will attempt to use their own heads.

### MEMS technology Printheads from Spectra

Fujifilm is the new owner of the company that makes Spectra printheads, but most people in the industry still think of them as Spectra (in part because of the brand recognition for Spectra). Their new MEMS printheads were introduced at an IMI conference ([www.imiconf.com](http://www.imiconf.com)) and now these innovative heads are already being shown, in the Raster Printers Daytona T600UV (at ISA 2007). So far, these heads seem more advanced than those of Scitex, but Scitex addresses a different market (billboards that don't need legible 3 pt type).

So now the commercial battle continues between Spectra and Xaar (the license holder for grayscale technology that is used by Toshiba Tec). Toshiba Tec won the first round because its heads got out first, and the quality of their output can be awesome. There are not yet enough finished printers using the Spectra MEMS heads, and their grayscale implementation for variable droplet sizes is so new it is not yet in enough printers to see how it works in comparison to that of ToshibaTec.

Raster Printers was the first UV-curable inkjet company that used MEMS printheads in a wide-format inkjet production printer. About eight months later L&P launched their giant UV combo-style printer also with MEMS printheads.



Fujifilm booth at ISA 2007

Raster Printers Daytona T600UV
L&P Virtu HD8
InkTec Jetrix
Yuhan-Kimberly VU-180

The Yuhan-Kimberly is an adapted Keundo textile printer and is not UV-cured ink whatsoever; it uses normal water-based textile inks.

Since these MEMS heads have two serious issues: production yield and problems once they are used in a printer, they have not been successful. Spectra no longer offers them, a mistake which cost Raster Printers, L&P, InkTec, and Yuhan-Kimberly millions of dollars in losses as well as lost time. I am under NDA with Spectra but these comments are based on public knowledge that every ink person and every printer manufacturer in the world knows and openly discusses.

Indications from end-users is that “one head fails per month” of the Spectra M Class, which is actually better than the failure rate of the X2 heads from HP. But realize that the failure rate depends on whether the heads you are using were correctly manufactured to begin with. If you simply take the heads from the production line and stick them into a printer, they fail at the rate of about one a day (remember, these printers use 48 heads (some of the L&P printers) to hundreds (the HP Scitex printers).

Another comment is that “Sun never came up with a specific ink for the MEMS heads of Spectra.” I was also told that “the heads couldn’t push the ink.” Though this is a technical question. I can’t judge whether this is an ink starvation problem (the ink tubing distribution and pumping situation) or the printhead itself.

### **MEMS Printheads from Kodak**

The Kodak MEMS printheads are not being specifically developed for use in graphics or wide-format inkjet printers per se.

### **Thermal Printheads and UV-cured Inks**

I always simply assumed that UV-curable inks required a piezo printhead. But at the IMI conferences on UV-cured inkjet technology in Lisbon, Portugal, several speakers make it clear that normal thermal printheads could be used. Does this mean that HP and Canon can develop UV-curable inkjet printers with their heads?

In theory, yes, Dr Alan Hudd specifically mentions that Canon bubble-jet printheads can use water-based UV-curable inks. He mentioned that the same would be applicable to HP printheads.

Wow, does this mean that the next several years will result in some fascinating new wide format inkjet technology? Not really, because there are plenty of industrial printheads that already handle UV ink quite well. All these are piezo heads. So far Epson are about the only piezo printheads that don’t handle UV inks at all well.

## Why most printer manufacturers tend not to experiment with other heads

Printhead companies generally require that a printer manufacturer buy a complete development kit. This is one reason not too many manufacturers experiment with Kyocera printheads. Most printhead companies require a “tithe” or “tax,” a payment for all ink that flows through their printheads. Epson is most notorious in this respect.

### General Observations

Seemingly there is a trade off between high-resolution heads and image quality in areas of solid color. Areas of solid color are reportedly accomplished best by large picoliter drops at low resolution. However you need smaller droplet sizes to achieve crisp text at sizes from 6 to 10 pts. Some printer manufacturers are turning to improved heads; James Gandy is improving his software with to remain with his favored traditional Spectra heads. So there are several ways to tweak improved quality out of a system.

New for 2006-2007 is the Oce Arizona 250GT UV printer. Like Mimaki, they decline to identify their printheads, but if it has grayscale technology, that limits it to a few possibilities. And sooner or later we will find out the brand name of these heads, so it is kind of silly for them to hide the source. Besides, hiding the name of your printheads is not being up front with the people you are asking to buy your printer.



*Oce Arizona 250GT UV*

## Summary: printheads in UV printers

Early premature versions of some printheads have contributed to the poor performance of some UV printers. Of the UV printers that have failed in the marketplace:

- Azero Creon (Hypernics)
- Digital Jet Technologies, DJT
- Eastech
- HP Scitex XL2200
- Oce Arizona 60UV
- Oce Arizona T220uv
- Zünd XY-Flat
- Zünd 250
- The Azero used an early Konica head.
- DJT used, or tried to use, the PicoJet head technology.
- Oce used Xaar heads for both their models. The model 60UV failed in part because of a weak materials feeding system and in part because of a lackluster ink. The Oce 220uv failed because it was a Mack truck with a weak Yugo-like engine. The Xaar printheads were one cause of the inadequate performance of the T220uv.
- Eastech and Zünd tried to use the Epson printhead. The Eastech printers that use other printheads have survived.
- HP Scitex XL2200 used the X2 MEMS head.

So, it appears that printheads have been a contributing case to the failure of several printers. Trying to use cationic UV ink was the main cause of the failure of the Zünd 250 printer: as soon as they switched to free-radical UV ink, the printer worked quite nicely.

Cheap Chinese printers use Xaar printheads to keep their cost down: Infiniti, Skyjet, Yishan are examples. Indeed the two factors that have allowed Xaar to survive are purchases by Chinese solvent ink manufacturers and massive amounts of investment capital by Agfa. Today Chinese printers try to feature much better printheads in their cheap printers, hoping that end-users will be impressed by the state-of-the-art printhead and thereby that end-users will be convinced that Chinese printers are advanced machines.

But it takes far more than a printhead to make a printer function adequately. It does little good to place a modern well-made printhead into a machine with weak materials, slipshod workmanship, and parts copied from the better-made originals.

At least two printer manufacturers started with Xaar printheads and quickly switched to Spectra heads:

- Durst
- Inca

At DRUPA 2004 Tampoprint showed a non-functioning flatbed printer. I assumed it was UV, but it may have been solvent ink, since at FESPA 2005, all the Tampoprint wide format flatbeds were solvent ink. Reportedly the Tampoprint used a printhead from IJT, a company that has subsequently gone out of business (?). This was the worst quality of any printer that I have seen in recent times, matched or exceeded only by the Seiko oil-based printer or the XES (Xerox) Xpress 54 oil-based printer.

The trends are clear: atypical, unusual, or non-standard printheads don't do well in the UV-cured ink flatbed printer marketplace. The Hitachi Ricoh and Toshiba Tec heads are the exception. Spectra heads are the most sought after though the Ricoh and Toshiba Tec also provide excellent quality.



MEMS printheads have proven to be the first major new technology which has failed and the first time that Spectra had a product that was unsatisfactory (their M Class heads). The X2 printheads of Scitex Vision (that they bought from Pixdro) also have not been successful (at least not in the XL2200 printer that was prematurely released at SGIA 2007). Whether the X2 printheads will be successful in the new HP Scitex flatbed printer shown at SGIA 2008 remain to be seen. This printer was not exhibited at ISA 2009 but I assume it will be shown at FESPA '09.

## Firing Frequency is one crucial Spec

The higher the firing frequency, potentially the faster the printhead can fire droplets. Spectra heads tend to have a higher firing frequency than Xaar heads. But Xaar developed greyscale technology first (which you see in the Toshiba Tec heads which use Xaar licenses so they are allowed to use Xaar patents). So there are many factors that determine quality. What counts are reliability and the quality you see with your own eyes.

If you are using your UV printer primarily for proofing, then quality may be more important than speed. If you are using your UV printer primarily for banners and billboards, speed is important because you don't need to have 3 pt type legible (or even 36 pt type on a billboard seen along a highway).

## Appendix A: Tabulations

The following specs are what we could locate. Most printer manufacturer spec sheets avoid mentioning most details all together, so locating documentation is a challenge. Information on cost of the printhead and realistic life are effectively unavailable. L&P, for example, provides the least information. Most Chinese manufacturer spec sheets are minimalist.

We will do our best to update this chart at DRUPA 2008.

We are not able to automatically send updates, nor reserve updates in advance. But if you write us, we will do our best to get an update to you, at no cost (if an update exists).

	Nozzles	Drop size in pL	Firing frequency	Best known printers that use this printhead
Agfa-Xaar	764	8 to 120	8 kHz	Agfa Anapurna 100 Mutoh Cobra 100 Thieme M Press
Durst-Spectra		40 to 50	variable	Durst Rhopac Durst Rho 600
Epson's older heads, circa 2004-2006				Eastech Octra Zünd XY-flat Probably prototypes of the unfinished Roland flatbed
Hitachi Ricoh 96 E1	96	30		ColorSpan 72UVR, Teckwin 1800
Hitachi E2	128			
HP Scitex X2	128	50		HP Scitex XL2200

Konica				Azero Creon Azon Hypernics
Newer Konica Minolta heads	IP&I (successor firm to Hypernics in Korea) GRAPO Manta flatbed			
Kyocera	Not yet successful in actual wide-format UV production printers, probably because most people are already content with whatever head they already use.			
Panasonic	Not yet successful in actual wide-format UV production printers, probably because most people are already content with whatever head they already use.			
PicoJet	Not yet successful in actual wide-format UV production printers. The one printer that tried them failed (but it had so many other issues it may not have been problem of printhead alone).			
Ricoh E3 (or Gen3)				Matan, and a new flatbed to be shown at DRUPA '08 DYSS
Ricoh E4	More on this printhead after SGIA '08			
Seiko JetT510	510	35	6-8 kHz	PIT Sprint II, made in Bulgaria, sold in Spain.  VUTEk QS 2000, QS 3200
Spectra SE 128	128	30		Raster Printers RP-720 UV
Spectra SL 128	128	75-80		Gandinnovations JETi UV <sup>2</sup> Sun FastJet
Spectra SM 128	128	50		Lüscher JetPrint 3530
Spectra Nova	256	75		Agfa and Mutoh versions of Dilli Dilli itself DuPont (for white ink) Eastech Scutum GO Fuzion
Spectra Galaxy	256	30		Dilli option DuPont Cromaprint 22UV DuPont Cromaprint 18uv
Spectra MEMS	304	10	40 kHz	Raster Printers Daytona T600UV, L&P Virtu HD8
Toshiba Tec	318	6	4.8 kHz	Mimaki UV New Flora F1 180 UV Oce Arizona 250 GT
Toshiba Tec newer version				Flora F1 180UV and all European versions, and Raster Printers H700UV
Xaar 126 200				
Xaar XJ 126 300	126	45 to 50		Gerber Solara Infiniti Xterius
Xaar XJ128				
Xaar XJ 128+				
Xaar XJ 500	500	40		Grapo Octopus, ScitexVision VEEjet, Yishan (China) distributed as Digirex by PIMMS, TeckSmart UV1600
Xaar OmniDot 760				Teckwin TeckStorm flatbed, Mutoh Zephyr hybrid

<sup>2</sup>Gandinnovations printers use several different Spectra heads; it depends which model of Gandy printer that you buy.



	Printhead brand	Printhead model	Nozzles	Drop size	Drop size	Firing freq	Replacement cost for head
Aellora, labels	Spectra						
SureFire TKMP1000	Spectra						
Agfa :Dotrix	ToshibaTec						
:Anapurna 100							
Anapurna/Dilli	Spectra	Nova 256/80					
Anhui Liyu Lyric	Spectra	Galaxy JA	256				
Ardeje							
Azero Creon, Azon, Hypernics	Konica						
B&P LightBrigade, OEMs Neolt and other brands, see original manufacturer for specs							
Digirex (Yishan)	Xaar	XJ500-360					
Digirex (Yishan)	Spectra	Galaxy	256				
Dilli	Spectra	Nova					
Dilli, optional	Spectra	Galaxy	256				
Dilli Titan							
DuPont 22uv	Spectra	Galaxy	256				
DuPont 18uv	Spectra	Galaxy	256				
Durst Rho 160	Spectra						
Durst Rho 160R	Spectra				Version that uses 3M ink		
Rho 205	Spectra						
Rho 600	Spectra						
Rhopac	Spectra						
Rho 350R	Spectra						
Eastech Octra	Epson						
Eastech Scutum	Spectra	Nova	256				
Eastech option							
Flora 1800	Spectra		128				
Flora 180UV	ToshibaTec						
Gandi flatbed	Spectra						
Gandi Jeti RtR	Spectra						
GCC Stellar 183	Konica	KM 518	512				
GCC Stellar 250	Xaar	Xaar 500					
Gerber/Spandex	Xaar	Xaar 126	126				
Grapo original							
Grapo Octopus	Xaar	XJ500-360					
Grapo Manta	Konica						
HP Scitex FB6300	Xaar	XJ500		Rebadged Scitex Vision VEEjet+			
HP Scitex FB6500	HP Scitex	X2	128	Slight update by HP to old VEEjet+			

HP Scitex TJ8500				UV version of TURBOjet solvent			
HP Scitex				New roll-to-roll coming soon.			
Inca original	Xaar						
Inca Eagle							
Columbia							
Columbia 220							
Columbia Turbo							
Inca Spyder 150	Spectra						
Inca Spyder 320	Spectra	S128	128				
Infiniti UV1612S	Xaar	XJ-126 300	126				
IP&I Cube 260	Konica						
IP&I Cube 1.6 m							
JHF							
L&P original	Spectra		128				
L&P today	Spectra						
Lüscher	Spectra	SM 128	128				
Mimaki UJV-110	ToshibaTec						
UJF-605c	ToshibaTec						
UJF-605“R”	ToshibaTec						
IPF-1326, JF-1631	ToshibaTec						
IPT-1616	ToshibaTec						
Mutoh Cobra 100 (Agfa)	Agfa-Xaar						
Mutoh Cobra S65uv (Dilli)	Spectra	Nova					
NeoltJet	Spectra		128				
NUR Tempo I	Spectra	Nova Q					
NUR Expedio	Spectra						
Oce 60UV	Xaar		128				
Oce T220UV	Xaar						
Oce new 250 GT	Toshiba Tec			Grey-scale technology.			
PIT Sprint II	Seiko						
Raster Printers 720UV and UVZ	Spectra						
RP Daytona	Spectra						
RP Daytona T600UV	Spectra	MEMS	304				
Scitex Vision VEEjet	Xaar	XJ500					
Skyjet							
Sun FastJet	Spectra	SL	128			20kHz	
TeckSmart 1600	Xaar	500-300	512				
Teck UV 1800	Hitachi	3E1					
TeckUV S2400 TeckUV S3000							
Vutek, original							

PressVu 180							
PressVu 200	Spectra	Galaxy	256				
PressVu 320	Spectra	Galaxy	256				
QS2000, 3200	Seiko	Jet510	510				
Yaselan							
New UV printer	This new printer will utilize MEMs printheads, but not from HP						

There is no industry standard on how resolution is defined. Toshiba Tec lists “channels per inch” which would be nozzles per inch. Agfa also lists their nozzles per inch (two staggered rows of 180 to equal 360), to produce a claimed dpi of 720.

### Beware:

### Merely Having a Good Head Does not mean the overall printer is acceptable

Chinese-made printers change printheads quickly, trying to impress end-users with a well-made printhead brand name, hoping the buyer will assume that the entire printer is as good as the printhead. So no one can keep up with the spec sheets of these printers. We list what we have available, which is more comprehensive than most other sources.

For further Reading

	Web sites
Agfa-Xaar	<a href="http://www.agfa.com">www.agfa.com</a>
Durst-Spectra	<a href="http://www.durst.it">www.durst.it</a>
Epson	<a href="http://www.Epson.com">www.Epson.com</a>
Hitachi Ricoh	Virtual silence on both heir web sites.
HP Scitex X2	<a href="http://www.hp.com">www.hp.com</a>
Kodak	<a href="http://www.kodak.com">www.kodak.com</a>
KonicaMinolta	<a href="http://konicaminolta.com/products/inkjethead/index.html">http://konicaminolta.com/products/inkjethead/index.html</a>
Kyocera	<a href="http://www.kyocera.com">www.kyocera.com</a>
Panasonic	Search on their web site reveals “no search results”
PicoJet	<a href="http://www.picojet.com">www.picojet.com</a>
Ricoh	Very sparse info unless you have eternal patience
Seiko	<a href="http://www.siiprintek.co.jp">www.siiprintek.co.jp</a> , <a href="http://www.triteck.com">www.triteck.com</a>
Spectra	<a href="http://www.spectra-inc.com">www.spectra-inc.com</a> jumps you to <a href="http://www.dimatix.com">www.dimatix.com</a>
Toshiba Tec	<a href="http://www.toshibatec.co.jp">www.toshibatec.co.jp</a>
Xaar	<a href="http://www.xaar.co.uk">www.xaar.co.uk</a>

## Appendix B

### Questions, to be asked of Printheads

When you are shopping around for a new UV-cured ink printer, there are some basic questions you should ask about its printheads. We list some of the questions here. A longer list is in the new UV Series #4 FLAAR Reports, available by late January or early February 2007.

We can't list all the answers because those depend on which of over 60 different printer models you are looking at.

#### 1. Which brand and which model of printhead is used?

Most printer spec sheets do not list the printhead. When you ask what printhead, you are usually told the brand, but not the model of the printhead. Mimaki does not reveal what printhead it uses; they simply won't tell you. But in a few hours research you can find out on your own: Toshiba Tec. These are excellent printheads, so there is no need to keep it a secret. The Agfa :Dotrix uses similar heads.

Once you know the name and model number of head, you can go onto the company website and see all the specs of the head (all the information that most printer manufacturers don't have in their own spec sheets).

#### 2. Is this a printhead adapted from solvent ink or a new design made especially for UV ink chemistry?

Some heads just were not made originally to handle UV-cured inks. Epson heads are an example. This does not mean they can't jet UV-curable inks, it just means they may require special inks. So it does help to learn whether the heads you are about to end up with, whether they are made to handle UV-inks from the beginning.

#### 3. How many other printers utilize the same printhead? Have they shown any problems?

Both Xaar and Spectra are piezo electric printheads. These are industrial strength piezo printheads, as compared to Epson piezo printheads which are more for home and hobby printers.

Durst started out with Xaar heads and then switched to Spectra.

Mutoh used to use Xaar printheads and then switched to Spectra.

Need we say more. But Xaar heads do improve with quality with every new generation and some features of Xaar heads may be preferred for certain applications.

#### 4. How many nozzles per printhead?

This figure may help you know how fast, or slow, your printer will be.

#### 5. How many printheads per color?

This will tell even more about how slow, or fast, your printer can jet ink.

#### 6. How many total number of printheads?

Some individual printheads can be divided, and jet more than one color (half of the jets one color; the other half another ink). More expensive printers have 6 heads, per color.

#### 7. What is the picoliter drop size? Is there variable droplet capability.

80 picoliters is the drop size for 2002-2004. 30 picoliters is the drop size for 2005. Next year it will be 8 picoliters. But soon all printheads have small drop size. Then other factors become more important. Do don't get misled by numerology.

**8. What is the advertised DPI, and is it true dpi or “apparent” dpi?**

Lots of smoke and mirrors and misinformation in the dpi figures. There are not really any standard methods to create the dpi specs, so some printer manufacturers get very inventive. Epson is the most inventive of all.

**9. How many passes can this printer achieve?**

This means how many times can the printheads go back and forth, essentially over the same area, to interweave and cover up for nozzles that are out.

**10. What is the firing frequency of the printheads (in KHz)? Can the firing frequency be varied by the end-user? What is the effect of changing the firing frequency of the heads?**

This starts getting technical quick. If you need to know this information, you ought to attend an IMI Conference with lectures by the printhead manufacturers.

**11. Since most UV-curable ink printers are still being upgraded and improved as experience accumulates, what are the chances that this brand of printer will have new, different, or revised heads in the next year? If such new heads come out, are you stuck with the old ones?**

Printers do evolve, and sometimes new printheads are added to second-generation versions to make them faster, or better in some respect.

**12. What is true life expectancy of this print head? Is the printhead considered a consumable? The only acceptable answer is in liters of ink or some meaningful measurement that a normal printshop person can understand. “drops” is not a measurement that is very realistic for a person to comprehend.**

Xaar printheads are often considered a consumable. Spectra printheads last longer but are correspondingly more expensive.

**13. If this piezo head fails, who is responsible for paying for replacement heads?**

**What are the most common causes of printhead failure? Which of these causes of failure are covered by the warranty? Which causes of printhead failure are not covered by the warranty? Is there a limit to the number of printhead failures that are covered over a unit of time. You need to check your warranty.**

Most warranties do not pay for replacement of printheads if it was user error that caused the failure. Most failures are indeed user error; the most common cause is a head strike.

**14. How often can you expect head strikes? What causes them? Who will replace the printheads and at whose cost?**

Head strikes are the most common cause of premature head failure (another cause is constant flushing; the flushing seemingly wears out the nozzle system). A single head strike may wipe out only a few nozzles, or may kill the entire printhead. Head strikes may be occasioned by a diverse variety of situations:

- Improper loading of the media, which make cause buckling, because the media is caught, or not going through the printer properly.
- Thin media can curl, thereby causing a head strike on the curled part
- Edge guards, which work on paper, canvas, and other thin materials, are not intended for thick material such as fome-cor.
- If media is absorbent, too much ink can make the material bubble up
- If media is curled or bubbled by heat; the head can hit the raised part
- If media is defective to begin with, or uneven, the head can hit the raised part
- If you have cut the material, such as Fome-Cor, the raised edge can cause a head strike.
- If adhesive pulls off the material (such as Controltak), the adhesive may get stuck on the nozzle plate of the head.

- Some material is like sandpaper to the nozzle plate, some papers, and metal (and the metal edge is another danger to the printhead nozzle plate).

**15. What does each printhead cost to replace? Distinguish price for the printhead and also price for the service technician to come and do the installation if it is not user-replaceable?**

Static can cause a head to short out and thereby to fail. An electronics failure and severe head clogging can also cause a printhead to cease working properly.

**16. What else, besides a head strike, can cause a head to fail prematurely?**

Excessive flushing can conceivably cause a head to fail prematurely.

**17. Is negative pressure required to maintain the ink (without the ink dripping out the printhead when the machine is turned off)?**

Most printheads require negative pressure. The question is whether this can be turned off when you put the printer to rest at night. ColorSpan printers must have negative pressure 24-hours a day. Others can be put to sleep. These are not positive and negative features, just structural differences.

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2005 New M-Class: Shaped Piezo Silicon MEMS – A Breakthrough in Piezo Printhead Design for Industrial Printing & Decorative Applications. 13th Annual European Ink Jet Printing Conference, November 2005, Lisbon.

### **HUDD, Alan L.**

2005 UV Product Implementation & Applications. UV Ink Jet Printing Course. Nov 2005, Lisbon, IMI-Europe.

### **TEMPLE, Steve**

2005 Hybrid Sideshooter – Latest Developments in Piezo DOD Printhead Architecture. IMI 13th Annual European Ink Jet Printing Conference. Lisbon, November 2005.

This presentation discusses Xaar grayscale printhead technology, used by licensees Agfa and Toshiba Tec, among others. Toshiba Tec heads are used by Agfa ;Dotrix and by Mimaki UV printers. Agfa printheads are used by Mutoh Cobra and the Thieme M Press (but not by Agfa's own ;Dotrix).



## Information Directly from Printhead Manufacturers

[www.dimatix.com/technology/spectra-piezoelectric.asp](http://www.dimatix.com/technology/spectra-piezoelectric.asp)

Tidbits of information, with a few illustrations.

[www.seyboldreports.com/TSR/subs/0217/xaar.pdf](http://www.seyboldreports.com/TSR/subs/0217/xaar.pdf)

“Xaar: At the Heart of Industrial Ink-Jet Printing” by Andy Tribute. The Seybold Report, Vol. 2, No. 17, 6 pages. Dated 2002, so long ago superseded, but still useful.

[www.xaar.co.uk/Xaar\\_printing\\_technology\\_news/overview.htm](http://www.xaar.co.uk/Xaar_printing_technology_news/overview.htm)

Overview on printheads. With illustrations.

[www.xaar.co.uk/printheads\\_xj126.htm](http://www.xaar.co.uk/printheads_xj126.htm)

[www.xaar.co.uk/printheads\\_xj128.htm](http://www.xaar.co.uk/printheads_xj128.htm)

[www.xaar.co.uk/printheads\\_xj128\\_200\\_plus.htm](http://www.xaar.co.uk/printheads_xj128_200_plus.htm)

[www.xaar.co.uk/printheads\\_xj128\\_360\\_plus.htm](http://www.xaar.co.uk/printheads_xj128_360_plus.htm)

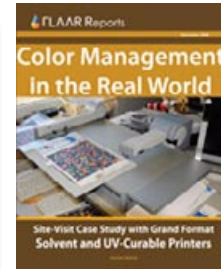
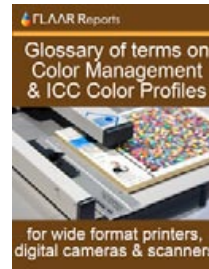
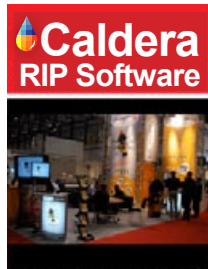
[www.xaar.co.uk/printheads\\_xj500.htm](http://www.xaar.co.uk/printheads_xj500.htm)

[www.xaar.co.uk/printheads\\_XJ500\\_MAX.htm](http://www.xaar.co.uk/printheads_XJ500_MAX.htm) (data sheet not available as of mid-June 2005). What you want is not so much this page itself, but the PDF version of the datasheet, which is a download from the bottom of this Xaar page.

FLAAR has a separate complete bibliography, including on articles in trade magazines, material in article format as PDFs, downloadable on the Internet. In that separate PDF we also list White Papers, spec sheets, general information, and other items available on the Internet that we know about.

## Most recently updated updated March 2010.

Previously updated January 2007, November 2007, April 2008. Updated June 2008 after DRUPA, March 2009, May 2009.



These reports on RIP software and Color Management for serious UV printers are free downloads on all FLAAR web sites (follow the link to 'free downloads') [http://www.wide-format-printers.net/reviews\\_reports\\_evaluations/free\\_download.php](http://www.wide-format-printers.net/reviews_reports_evaluations/free_download.php)

## RIP, COLOR MANAGEMENT, and ICC Color Profiles options

Once you have a serious UV-curable wide-format printer, you may prefer to have an equally serious RIP software and color management equipment.

The RIP software for simple water-based printers such as Canon, Epson, and HP may not be the same RIP software that could be most effective and productive on a UV-curable flat-bed or UV-cured roll-to-roll production printer.

I first noticed Caldera RIP on Gandinnovations UV printers several years ago, then I saw Caldera being used at the Mutoh Europe factory demo room in Belgium.

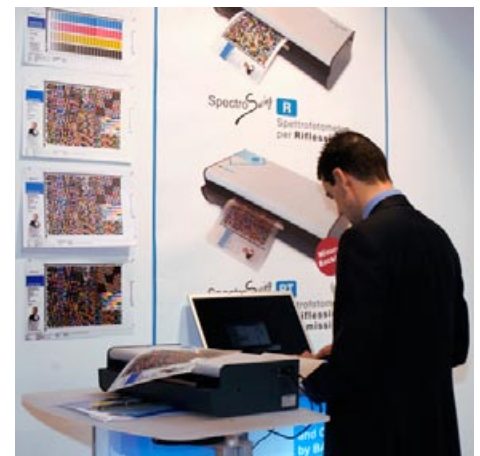
When I was visiting the Durst factories in Europe I again noticed that they were using Caldera RIP software.

So I requested access from Caldera so I could visit their world headquarters in Strasbourg, France, to spend several days learning more about their RIP. As a result there is now a FLAAR Report photo essay on this software.

Most recently I have seen Caldera RIP at the Shanghai printer trade show in China, at DRUPA in Germany, at FESPA Digital in Geneva, SGIA '08 and Viscom Italy '08.

When I visited a large printshop in Maribor, northern Slovenia, they were using Caldera RIP and the manager of technical services for this company said, "Caldera does a good job." This company in Slovenia has about eight UV printers (about five of them from Durst) and an equal number of large solvent printers. They originally used a GretagMacbeth color man-

agement system but switched to BARBIERI because the BARBIERI spectrophotometer can read more efficiently and can handle textiles, backlit, wood and other materials that are either awkward or difficult on other brands of color management instruments. You can learn about the BARBIERI equipment either from their headquarters in Brixen or their distributors worldwide.



Caldera also offers a highly regarded spectrophotometer from Barbieri, the leading color management company in Italy (they are headquartered in the same city as Durst, the manufacturer of Rho UV-cured printers).

**For further information on Caldera**

contact Joseph MERGUI

[mergui@caldera.fr](mailto:mergui@caldera.fr)

**If you have questions about color management**, if you are in the US you can contact: ImageTech at:

[www.ImageTechDigital.com](http://www.ImageTechDigital.com)

Mark Spandorf (owner and president),

[mark@imagetechdigital.com](mailto:mark@imagetechdigital.com)

or 510 238-8905.

If you are in Europe or the rest of the world you can contact **BARBIERI** directly at: BARBIERI electronic snc,

[info@BARBIERIElectronic.com](mailto:info@BARBIERIElectronic.com)

[www.BARBIERIElectronic.com](http://www.BARBIERIElectronic.com)

Tel.: +39 0472 834 024

Fax: +39 0472 833 845

**Reality Check**

Being a university professor for many years does not mean we know everything. But intellectual curiosity often leads us to enter areas that are new to us. So we do not shirk from entering areas where we are obviously not yet expert. In your years of wide format printing experience have encountered results different than ours, please let us know at [ReaderService@FLAAR.org](mailto:ReaderService@FLAAR.org). We do not mind eating crow, though so far it is primarily a different philosophy we practice, because since we are not dependent on sales commissions we can openly list the glitches and defects of those printers that have an occasional problem.

FLAAR and most universities have corporate sponsors but FLAAR web sites do not accept advertising, so we don't have to kowtow to resellers or manufacturers. We respect their experience and opinion, but we prefer to utilize our own common sense, our in-house experiences, the results from site-visit case studies, and comments from the more than 53,000 of our many readers who have shared their experiences with us via e-mail (the Survey Forms).

**Licensing Information**

If you wish to distribute this report to other people within your company, please obtain a site licensing agreement for multiple copies from FLAAR by contacting [ReaderService@FLAAR.org](mailto:ReaderService@FLAAR.org). Substantial discounts are available for licensing to distribute within your company; we call this a subscription. The advantage of a subscription license is that you can opt for automatic updates. You may have noticed that FLAAR reports tend to be updated as additional information becomes available.

In some instances a license would be available to distribute outside your company, including in other languages.

**To distribute this report without subscription/license violates federal copyright law.** To avoid such violations for you, and your company, you can easily order additional copies from [www.wide-format-printers.NET](http://www.wide-format-printers.NET).

**Update Policy**

Starting in 2008, updates on UV-curable wide-format inkjet printers are available for all individuals and companies which have a subscription, or to companies who are research project sponsors. If you are a Subscriber or manager in a company that is a research sponsor, you can obtain the next update by writing [ReaderService@FLAAR.org](mailto:ReaderService@FLAAR.org). If you are neither a Subscriber or a research sponsor, simply order the newest version via the e-commerce system on [www.wide-format-printers.NET](http://www.wide-format-printers.NET). Please realize that because we have so many publications and many are updated so frequently that we have no realistic way to notify any reader of when just one particular report is actually updated.

There is a free PDF that describes the UV-curable inkjet printer Subscription system. Subscriptions are available only for UV-related wide-format printer publications.

FLAAR Reports on UV-curable roll-to-roll, flatbed, hybrid, and combo printers are updated when new information is available. We tend to update the reports on new printers, on printers that readers ask about the most, and on printers where access is facilitated (such as factory visits, demo-room visits, etc).

Reports on obsolete printers, discontinued printers, or printers that not enough people ask about, tend not to be updated.

FLAAR still publishes individual reports on solvent printers, and on giclee printers, but subscriptions on these are not yet available; these FLAAR Reports on solvent, eco-solvent, and water-based wide format printers have to be purchased one by one.

**Please Note**

This report has not been licensed to any printer manufacturer, distributor, dealer, sales rep, RIP company, media, or ink company to distribute. So, **if you obtained this from any company, you have a pirated copy.**

**If you have received a translation, this translation is not authorized unless posted on a FLAAR web site, and may be in violation of copyright (plus if we have not approved the translation it may make claims that were not our intention).**

Also, since this report is frequently updated, if you got your version from somewhere else, it may be an obsolete edition. FLAAR reports are being updated all year long, and our comment on that product may have been revised positively or negatively as we learned more about the product from end users.

If you receive any FLAAR Report from a sales rep, in addition to being violation of copyright, it is useful to know if there is a more recent version on the FLAAR web site, because every month new UV printers are being launched. So what was good technology one month, may be replaced by a much better printer elsewhere the next month.

To obtain a legitimate copy, which you know is the complete report with nothing erased or changed, and hence a report with all the original description of pros and cons, please obtain your original and full report straight from [www.FLAAR.org](http://www.FLAAR.org).

**Your only assurance that you have a complete and authentic evaluation which describes all aspects of the product under consideration, benefits as well as deficiencies, is to obtain these reports directly from FLAAR, via [www.wide-format-printers.NET](http://www.wide-format-printers.NET).**

**Citing and Crediting**

A license from FLAAR is required to use any material whatsoever from our reports in any commercial advertisement or PR Release.

If you intend to quote any portion of a FLAAR review in a PowerPoint presentation, if this is in reference to any product that your company sells or promotes, then it would be appropriate to ask us first. FLAAR reports are being updated every month sometimes, and our comment on that product may have been revised as we learned more about the product from end users. Also, we noticed that one company cited the single favorable comment we made on one nice aspect of their printer, but neglected to cite the rest of the review which pointed out the features of the printer which did not do so well. For them to correct this error after the fact is rather embarrassing. So it is safer to ask-before-you-quote a FLAAR review on your product.

The material in this report is not only copyright, it is also based on years of research. Therefore if you cite or quote a pertinent section, please provide a proper credit, which would be minimally "Nicholas

Hellmuth, year, [www.FLAAR.org](http://www.FLAAR.org).” If the quote is more than a few words then academic tradition would expect that a footnote or entry in your bibliography would reference the complete title. Publisher would be [www.FLAAR.org](http://www.FLAAR.org).

If you intend to quote any portion of a FLAAR review in a PowerPoint presentation, if this is in reference to any product that your company sells or promotes, then it would be appropriate to license the report or otherwise notify us in advance. FLAAR reports are being updated every week sometimes, and our comment on that product may have been revised as we learned more about the product from end users. Also, we noticed that one company cited the single favorable comment we made on one nice aspect of their printer, but neglected to cite the rest of the review which pointed out the features of the printer which did not do so well. For them to correct this error after the fact is rather embarrassing. So it is safer to ask-before-you-quote a FLAAR review on your product.

### Legal notice

Inclusion in this study by itself in no way endorses any printer, media, ink, RIP or other digital imaging hardware or software. Equally, exclusion from this study in no way is intended to discredit any printer.

### Advisory

We do our best to obtain information which we consider reliable. But with hundreds of makes and models of printers, and sometimes when information about them is sparse, or conflicting, we can only work with what we have available. Thus you should be sure to rely also on your own research, especially asking around. Find another trustworthy end-user of the same make and model you need to know about. Do not make a decision solely on the basis of a FLAAR report because your situation may be totally different than ours. Or we may not have known about, and hence not written about, one aspect or another which is crucial before you reach your decision.

The sources and resources we may list are those we happen to have read. There may be other web pages or resources that we missed. For those pages we do list, we have no realistic way to verify the veracity of all their content. Use your own common sense plus a grain of salt for those pages which are really just PR releases or outright ads.

We are quite content with the majority of the specific printers, RIPs, media, and inks we have in the FLAAR facilities. We would obviously never ask for hardware, software, or consumables that we knew in advance would not be good. However even for us, a product which looks good at a trade show, sounds good in the ad literature, and works fine for the first few weeks, may subsequently turn out to be a lemon.

Or the product may indeed have a glitch but one that is so benign for us, or maybe we have long ago gotten used to it and have a work-around. And not all glitches manifest themselves in all situations, so our evaluator may not have been sufficiently affected that he or she made an issue of any particular situation. Yet such a glitch that we don't emphasize may turn out to be adverse for your different or special application needs.

Equally often, what at first might be blamed on a bad product, often turns out to be a need of more operator experience and training. More often than not, after learning more about the product it becomes possible to produce what it was intended to produce. For this reason it is crucial for the FLAAR team and their university colleagues to interact

with the manufacturer's training center and technicians, so we know more about a hardware or software. Our evaluations go through a process of acquiring documentation from a wide range of resources and these naturally include the manufacturer itself. Obviously we take their viewpoints with a grain of salt but often we learn tips that are worthy of being passed along.

FLAAR has no way of testing 400+ specifications of any printer, much less the over 101 different UV printers from more than 46 manufacturers. Same with hundreds of solvent printers and dozens of water-based printers. We observe as best we can, but we cannot take each printer apart to inspect each feature. And for UV printers, these are too expensive to move into our own facilities for long-range testing, so we do as best as is possible under the circumstances. And when a deficiency does become apparent, usually from word-of-mouth or from an end-user, it may take time to get this written up and issued in a new release.

Another reason why it is essential for you to ask other printshop owners and printer operators about how Brand X and Y function in the real world is that issues may exist but it may take months for these issues to be well enough known for us to know the details. Although often we know of the issues early, and work to get this information into the PDFs, access to information varies depending on brand and model. Plus with over 300 publications, the waiting time to update a specific report may be several months. Plus, once a printer is considered obsolete, it is not realistic to update it due to the costs involved.

For these reasons, every FLAAR Report tries to have its publication date on the front outside cover (if we updated everything instantly the cost would be at commercial rates and it would not be possible to cover these expenses). At the end of most FLAAR Reports there is additionally a list of how many times that report has been updated. A report with lots of updates means that we are updating that subject based on availability of new information. If there is no update that is a pretty good indication that report has not been updated! With 101 models of UV printers, several hundred solvent printers, and scores of water-based printers, we tend to give priority to getting new reports out on printers about which not much info at all is available elsewhere. So we are pretty good about reporting on advances in LED curing. But glitches in a common water-based printer will take longer to work its way through our system into an update, especially if the glitch occurs only in certain circumstances, for example, on one type of media. With several hundred media types, we may not yet have utilized the problem media. While on the subject of doing your own research, be sure to ask both the printer operator and printshop owner or manager: you will generally get two slightly different stories. A printer operator may be aware of more glitches of the printer than the owner.

If a printer is no longer a prime model then there is less interest in that printer, so unless a special budget were available to update old reports, it is not realistic to update old reports. As always, it is essential for you to visit printshops that have the printers on your short-list and see how they function in the real world.

But even when we like a product and recommend it, we still can't guarantee or certify any make or model nor its profitability in use because we don't know the conditions under which a printer system might be utilized in someone else's facility. For ink and media, especially after-market third-party ink and media, it is essential that you test it first, under your conditions. We have no way to assure that any ink or media will be acceptable for your specific needs in your specific print shop. As a result, products are described "as is" and without warranties as to performance or merchantability, or of fitness



for a particular purpose. Any such statements in our reports or on our web sites or in discussions do not constitute warranties and shall not be relied on by the buyer in deciding whether to purchase and/or use products we discuss because of the diversity of conditions, materials and/or equipment under which these products may be used. Thus please recognize that no warranty of fitness or profitability for a particular purpose is offered.

The user is advised to test products thoroughly before relying on them. We do not have any special means of analyzing chemical contents or flammability of inks, media, or laminates, nor how these need to be controlled by local laws in your community. There may well be hazardous chemicals, or outgassing that we are not aware of. Be aware that some inks have severe health hazards associated with them. Some are hazardous to breathe; others are hazardous if you get them on your skin. For example, some chemicals such as cyclohexanone do not sound like chemicals you want to breathe every day. Be sure to obtain, read, and understand the MSDS sheets for the inks, media, and laminates that you intend to use. Both solvent, eco-solvent, and UV-curable inks are substances whose full range of health and environmental hazards are not yet fully revealed. It is essential you use common sense and in general be realistic about the hazards involved, especially those which are not listed or which have not yet been described. FLAAR is not able to list all hazards since we are not necessarily aware of the chemical components of the products we discuss. Our reports are on usability, not on health hazards.

Most inks are clearly not intended to be consumed. Obviously these tend to be solvent inks and UV-curable inks. Yet other inks are edible, seriously, they are printed on birthday cakes. Indeed Sensient is a leader in a new era of edible inks. Therefore the user must assume the entire risk of ascertaining information on the chemical contents and flammability regulations relative to inks, media or laminates as well as using any described hardware, software, accessory, service, technique or products.

We have no idea of your client's expectations. What students on our campus will accept may not be the same as your Fortune 500 clients. In many cases we have not ourselves used the products but are basing our discussion on having seen them at a trade show, during visiting a print shop, or having been informed about a product via e-mail or other communication.

### Results you see at trade shows may not be realistic

Be aware that trade show results may not be realistic. Trade shows are idealized situations, with full-time tech support to keep things running. The images at a trade show may be tweaked. Other images may be "faked" in the sense of slyly putting on primer without telling the people who inspect the prints. Most UV inks don't stick to all materials; many materials need to be treated.

Or the UV prints may be top-coated so that you can't do a realistic scratch test.

Both personnel have many standard tricks that they use to make their output look gorgeous. In about half the cases you will not likely obtain these results in real life: in most cases they are printing uni-directional, which may be twice as slow as bi-directional.

Trade show examples tend to be on the absolutely best media. When you attempt to save money and use economy media you will quickly notice that you do not get anywhere near the same results as you saw in the manufacturer's trade show booth, or pictured in their

glossy advertisement. Five years ago we noticed Epson was laminating prints to show glossy output because their pigmented inks could not print on actual glossy media. The same equipment, inks, media, and software may not work as well in your facility as we, or you, see it at a trade show. All the more reason to test before you buy; and keep testing before you make your final payment. Your ultimate protection is to use a gold American Express credit card so you can have leverage when you ask for your money back if the product fails.

Images printed at trade show may be in uni-directional mode: so you may not realize the printer has bi-directional (curing) banding defects until you unpack it in your printshop. Bi-directional curing banding is also known as the lawnmower effect. Many printers have this defect; sometimes certain modes can get rid of it, but are so slow that they are not productive.

You absolutely need to do print samples with your own images and the kind provided by your clients. Do not rely on the stock photos provided by the printer, ink, media, or RIP manufacturer or reseller. They may be using special images which they know in advance will look fabulous on their printer. Equally well, if you send your sample images to the dealer, don't be surprised if they come back looking awful. That is because many dealers won't make a serious effort to tweak their machine for your kind of image. They may use fast speed just to get the job done (this will result in low quality). Check with other people in your area, or in the same kind of print business that you do. Don't rely on references from the reseller or manufacturer (you will get their pet locations which may be unrealistically gushy): find someone on your own.

### Factors influencing output

Heat, humidity, static, dust, experience level of your workers (whether they are new or have prior years experience): these are all factors that will differ in your place of business as compared with test results or demo room results.

Actually you may have people with even more experience than we do, since we deliberately use students to approximate newbies. FLAAR is devoted to assisting newcomers learn about digital imaging hardware and software. This is why Nicholas Hellmuth is considered the "Johnny Appleseed" of wide format inkjet printers.

Therefore this report does not warranty any product for any quality, performance or fitness for any specific task, since we do not know the situation in which you intend to use the hardware or software. Nor is there any warranty or guarantee that the output of these products will produce salable goods, since we do not know what kind of ink or media you intend to use, nor the needs of your clients. A further reason that no one can realistically speak for all aspects of any one hardware or software is that each of these products may require additional hardware or software to reach its full potential.

For example, you will most likely need a color management system which implies color measurement tools and software. To handle ICC color profiles, you may need ICC color profile generation software and a spectrophotometer since often the stock pre-packaged ICC color profiles which come with the ink, media, printers and/or RIPs may not work in your situation. Not all RIPs handle color management equally, or may work better for some printer-ink-media combinations than for others.

Be aware that some RIPs can only accept ICC color profiles: you quickly find out the hard way that you can't tweak these profiles nor

generate new ones. So be sure to get a RIP which can handle all aspects of color management. Many RIPs come in different levels. You may buy one level and be disappointed that the RIP won't do everything. That's because those features you may be lacking are available only in the next level higher of that RIP, often at considerable extra cost. Same thing in the progression of Chevy through Pontiac to Cadillac, or the new Suburbans. A Chevy Suburban simply does not have all the bells and whistles of the Cadillac Escalade version of this SUV.

Don't blame us... besides, that's why we are warning you. This is why we have a Survey Form, so we can learn when you find products that are inadequate. We let the manufacturers know when end users complain about their products so that the manufacturers can resolve the situation when they next redesign the system.

Most newer printer models tend to overcome deficiencies of earlier models. It is possible that our comparative comments point out a glitch in a particular printer that has been taken care of through an improvement in firmware or even an entirely new printer model. So if we point out a deficiency in a particular printer brand, the model you may buy may not exhibit this headache, or your kind of printing may not trigger the problem. Or you may find a work-around.

Just remember that every machine has quirks, even the ones we like. It is possible that the particular kind of images, resolution, inks, media, or other factors in your facility are sufficiently different than in ours that a printer which works just fine for us may be totally unsatisfactory for you and your clients. However it may be that the specific kind of printing you need to do may never occasion that shortcoming. Or, it may be that your printer was manufactured on a Monday and has defects that are atypical, show up more in the kind of media you use which we may not use as often or at all during our evaluations. Equally possibly a printer that was a disaster for someone else may work flawlessly for you and be a real money maker for your company.

So if we inspect a printer in a printshop (a site-visit case study), and that owner/operator is content with their printer and we mention this; don't expect that you will automatically get the same results in your own printshop.

In some cases a product may work better on a Macintosh than on a PC. RIP software may function well with one operating system yet have bugs and crash on the same platform but with a different operating system. Thus be sure to test a printer under your own specific work conditions before you buy.

And if a printer, RIP, media, or ink does not function, return it with no ands, ifs or buts. Your best defense is to show an advertising claim that the printer simply can't achieve. Such advertising claims are in violation of federal regulations, and the printer companies know they are liable for misleading the public.

But before you make a federal case, just be sure that many of the issues are not user error or unfamiliarity. It may be that training or an additional accessory can make the printer do what you need it to accomplish. Of course if the printer ads did not warn you that you had to purchase the additional pricey accessory, that is a whole other issue. Our reviews do not cover accessories since they are endless, as is the range of training, or lack thereof, among users.

The major causes of printer breakdown and failure is lack of maintenance, poor maintenance, spotty maintenance, or trying to jerry-rig some part of the printer. The equally common cause of printer breakdown is improper use, generally due from lack of training or experience. Another factor is whether you utilize your printer all day every day. Most solvent and UV printers work best if used frequently.

If you are not going to use your printer for two or three days, you have to put flush into the system and prepare it for hibernation (even if for only four or five days). Then you have to flush the ink system all over again.

Also realize that the surface of inkjet prints are fragile and generally require lamination to survive much usage. Lamination comes in many kinds, and it is worth finding a reliable lamination company and receiving training on their products.

Also realize that no hybrid or combo UV printer can feed all kinds of rigid materials precisely. Some materials feed well; others feed poorly; others will skew.

Although we have found several makes and models to work very well in our facilities, how well they work in your facilities may also depend on your local dealer. Some dealers are excellent; others just sell you a box and can't provide much service after the sale. Indeed some low-bid internet sales sources may have no technical backup whatsoever. If you pay low-bid price, you can't realistically expect special maintenance services or tech support later on from any other dealer (they will tell you to return to where you paid for the product). This is why we make an effort to find out which dealers are recommendable. Obviously there are many other dealers who are also good, but we do not always know them. To protect yourself further, always pay with a level of credit card which allows you to refuse payment if you have end up with a lemon. A Gold American Express card allows you to refuse payment even months after the sale. This card may also extend your warranty agreement in some cases (check first).

Most of the readers of the FLAAR Reports look to see what printers we use in our own facilities. Readers realize that we will have selected the printers that we like based on years of experience and research. Indeed we have met people at trade shows who told us they use the FLAAR web site reports as the shopping list for their corporate purchases.

Yes, it is rather self-evident that we would never ask a manufacturer to send a product which we knew in advance from our studies was no good. But there are a few other printers which are great but we simply do not have them in our facilities yet.

So if a printer is not made available by its manufacturer, then there is no way we can afford to have all these makes and models in our facility. Thus to learn about models which we do not feature, be sure to ask around in other print shops, with IT people in other corporations, at your local university or community college. Go to trade shows... but don't use only the booth...ask questions of people in the elevator, in line at the restaurant, anywhere to escape the smothering hype you get in the booth.

Realize that a FLAAR Report on a printer is not by itself a recommendation of that printer. In your local temperature, in your local humidity, with the dust that is in your local air, with your local operator, and with disorientation of the insides of a printer during rough shipment and installation, we have no knowledge of what conditions you will face in your own printshop. We tend to inspect a printer first in the manufacturing plant demo room: no disjointed parts from any shipment since this printer has not been lifted by cranes and run over a rough pot-holed highway or kept in smelting heat or freezing cold during shipment.

Taking into consideration we do not know the conditions in which you may be using your hardware, software, or consumables, neither the author nor FLAAR nor either university is liable for liability, loss or damage caused either directly or indirectly by the suggestions in this report nor by hardware, software, or techniques described herein because.



### Availability of spare parts may be a significant issue

Chinese printers tend to switch suppliers for spare parts every month or so. So getting spare parts for a Chinese printer will be a challenge even if the distributor or manufacturer actually respond to your e-mails at all. Fortunately some companies to have a fair record of response; Teckwin is one (based on a case of two problematical hybrid UV printers in Guatemala). The distributor said that Teckwin sent a second printer at their own expense and sent tech support personnel at their expense also. But unfortunately both the hybrid UV printers are still abandoned in the warehouse of the distributor; they were still there in January 2009. But Teckwin has the highest rating of any Chinese company for interest in quality control and realization that it is not good PR to abandon a client or reseller or distributor all together.

Recently we have heard many reports of issues of getting parts from manufacturers in other countries (not Asia). So just because you printer is made in an industrialized country, if you are in the US and the manufacturer is X-thousand kilometers or miles away, the wait may be many days, or weeks.

### Lack of Tech Support Personnel is increasing

The book of sales in the third quarter of 2008 resulted in many tech support problems.

The recession resulted in even more: some manufacturers may need to skimp on quality control during a recession, or switch to cheaper parts suppliers. Plus they are not hiring enough tech support during a recession. So the bigger and more successful the company, in some cases the worse these particular problems may be.

### Any new compiled printer may take a few months to break in

Any new printer, no matter who the manufacturer, or how good is the engineering and electronics, will tend to have teething issues. Until the firmware is updated, you may be a beta tester. This does not mean the printer should be avoided, just realize that you may have some downtime and a few headaches. Of course the worst case scenario for this was the half-million dollar Luscher JetPrint: so being "Made in Switzerland" was not much help.

### Counterfeit parts are a problem with many printers made in China

Several years ago many UV printers made in China and some made elsewhere in Asia had counterfeit parts. No evaluation has the funding available to check parts inside any printer to see if they are from the European, Japanese, or American manufacturer, or if they are a clever counterfeits.

### Be realistic and aware that not all materials can be printed on equally well

Many materials don't feed well through hybrid (pinch roller on grit roller systems) or combo UV systems (with transport belts). Banding, both from poor feeding, and from bi-directional (lawnmower effect) are common on many UV-curable inkjet printers.

It is typical for some enthusiastic vendors to claim verbally that their printer can print on anything and everything. But once you unpack the printer and set it up, you find that it requires primer on some materials; on other materials it adheres for a few weeks but then falls off.

And on most hybrid and many combo printers, some heavy, thick, or smooth-surfaced materials skew badly. Since the claim that the printer will print on everything is usually verbal, it is tough to prove this aspect of misleading advertising to a jury.

Not all inks can print on all materials. And at a trade show, many of the materials you see so nicely printed on, the manufacturer may be adding a primer at night or early in the morning: before you see the machine printing on this material.

We feel that the pros and cons of each product speak more than adequately for themselves. Just position the ad claims on the left: put the actual performance results on the right. The unscrupulous hype for some printers is fairly evident rather quickly.

### Be sure to check all FLAAR resources

Please realize that with over 200 different FLAAR Reports on UV printers, you need to be sure to check the more obscure ones too. If a printer has a printhead issue, the nitty gritty of this may be in the FLAAR Report on printheads. The report on the model is a general introduction; if we discussed the intimate details of printheads then some readers might fall asleep. And obviously do not limit yourself to the free reports. The technical details may be in the reports that have a price to them. Our readers have said they prefer to have the general basics, and to park the real technical material in other reports that people can buy if they really want that level of information.

So it may be best to ask for personal consulting. The details of the problems with the ColorSpan 5400uv series are rather complex: namely the center row of the Ricoh printheads. This would require an expensive graphic designer and consultants to show the details. And the design of the printhead would probably be altered by the time we did any of this anyway. So it is essential to talk with people: with other end-users, and with FLAAR in person on a consulting basis.

### Acknowledgements

With 19 employees the funding has to come from somewhere, so we do welcome project sponsorship, research grants, contributions that facilitate our educational programs, scholarships for co-op interns and graduate students, and comparable project-oriented funding from manufacturers. The benefit for the end-user is a principle called academic freedom, in this case,

- The freedom of a professor or student to speak out relative to the pros and cons of any equipment brought to them to benchmark.
- The freedom to design the research project without outside meddling from the manufacturer.

Fortunately, our budget is lean and cost effective as you would expect for a non-profit research institute. As long as we are not desperate for money we can avoid the temptation to accept payment for reprinting corporate PR hype. So the funding is used for practical research. We do not accept (nor believe) and certainly do not regurgitate corporate PR. For example, how many manufacturer's PR photos of their products have you seen in our reports or on our web sites?

Besides, it does not take any money to see which printers and RIPs function as advertised and which don't. We saw one hyped printer grind to a halt, malfunction, or otherwise publicly display its incapacibilities at several trade shows in a row. At each of those same trade shows another brand had over 30 of their printers in booths in virtually every hall, each one producing museum quality exhibits. Not our fault when we report what we see over and over and over again. One of our readers wrote us recently, "Nicholas, last month you recommended the ..... as one of several possible printers for our needs;

we bought this. It was the best capital expenditure we have made in the last several years. Just wanted to tell you how much we appreciate your evaluations....”

FLAAR is a non-profit educational and research organization dedicated for over 36 years to professional photography in the arts, tropical flora and fauna, architectural history, and landscape panorama photography.

Our digital imaging phase is a result of substantial funding in 1996 from the Japanese Ministry of Public Education for a study of scanning and digital image storage options. This grant was via Japan's National Museum of Ethnology, Osaka, Japan. That same year FLAAR also received a grant of \$100,000 from an American foundation to do a feasibility study of digital imaging in general and the scanning of photographic archives in particular.

The FLAAR web sites began initially as the report on the results of these studies of scanners. Once we had the digital images we began to experiment with digital printers. People began to comment that our reports were unique and very helpful. So by 1999 we had entire sections on large format printers.

FLAAR has existed since 1969, long before inkjet printers existed. Indeed we were writing about digital imaging before HP even had a color inkjet system available. In 2000 FLAAR received an educational grant from Hewlett-Packard large format division, Barcelona, Spain, for training, for equipment, and to improve the design and navigation on the main web sites of the FLAAR Network. This grant ran its natural course, and like all grants, reached its finishing point, in this case late 2005.

In some cases the sponsorship process begins when we hear end-users talking about a product they have found to be better than other brands. We keep our ears open, and when we spot an especially good product, this is the company we seek sponsorship from. It would not be wise of us to seek sponsorship from a company with a sub-standard or otherwise potentially defective printer. So we usually know which printers are considered by end-users to be among the better brands before we seek sponsorship. After all, out of the by now one million readers, we have heard plenty about every single printer out there.

We thank MacDermid ColorSpan (now part of HP), Hewlett-Packard, Parrot Digigraphic, Color DNA, Canon, Gandinnovations, and other companies for providing funding for technology training for the FLAAR staff and our colleagues at Bowling Green State University in past years and for funds to allow us to attend all major international trade shows, which are ideal locations for us to gather information. We thank Sun LLC, Caldera, EskoArtwork, Raster Printers (EFI Rastek), DEC LexJet, DigiFab, Barbieri electronic, Seiko II, Mutoh Europe, IP&I, Dilli, Yuhan-Kimberly, GCC, Grapo, Durst, and WP Digital for providing funds so that we can make more of our publications free to end-users. During 2000-2001 we had grants to cover all the costs of our publications, and all FLAAR Reports were free in those early years. As that early grant naturally expired after a few years, we had to begin charging for some of our reports to cover costs. Now (in 2009), we are seeking corporate sponsorship so we can gradually make another 20% of our publications free to our readers.

Since 2006 we do a major part of our evaluations at a factory and headquarters demo room. Since the university does not fund any of these trips, it is traditional for the manufacturer to fund a research sponsorship. In the US this is how most university projects are initiated for decades now, and it is increasing. In fact there is a university

in Austria that is not an “edu” but is a “GmbH”, funded by the chamber of commerce of that part of Austria. In other words, a university as an educational institution, but functioning in the real world as an actual business. This is a sensible model, especially when FLAAR staff need to be on the road over a quarter of a million miles per year (roughly over 400,000 km per year total for the staff). Obviously this travel is hosted since unless money falls from heaven there this most realistic way to obtain funding to get to the demo rooms for training is direct from the source.

It has been helpful when companies make it possible for us to fly to their headquarters so we can inspect their manufacturing facilities, demo rooms, and especially when the companies make their research, engineering and ink chemistry staff available for discussions. When I received my education at Harvard I was taught to have a desire to learn new things. This has guided my entire life and is what led me into wide-format digital imaging technology: it is constantly getting better and there is a lot to learn every month. Thus I actively seek access to improving my understanding of wide format printer technology so that we can better provide information to the approximately quarter-million+ readers of our solvent and UV printer web site ([www.large-format-printers.org](http://www.large-format-printers.org)) and the over half a million who read either our wide-format-printers.org site or our roughly half million combined who read our digital-photography.org and [www.FineArtGicleePrinters.org](http://www.FineArtGicleePrinters.org) sites.

Barbieri electronic (color management), Caldera (RIP), ColorSpan, DEC, Durst, EskoArtwork, Gerber, Grapo, IP&I, Mimaki USA, Mutoh, Dilli, GCC, NUR, Oce, Shiraz (RIP), Sky AirShip, Sun, Teckwin, VUTEk, WP Digital, Xerox, Yuhan-Kimberly, Zund have each brought FLAAR staff to their headquarters and printer factories. Bordeaux, InkWin and Sunflower ink have brought us to inspect their ink manufacturing facilities and demo rooms. We have visited the world headquarters and demo rooms of HP in Barcelona and received informative and helpful technology briefings roughly every two years. We are under NDA as to the subjects discussed but it is important that we be open where we have visited. Mimaki Europe has had FLAAR as their guest in Europe to introduce their flatbed UV printer, as have other UV-curable manufacturers, again, under NDA as to the details since often we are present at meetings where unreleased products are discussed. Xaar has hosted an informative visit to their world headquarters in the UK. You don't get this level of access from a trade magazine writer, and I can assure you, we are provided much more detailed information and documentation in our visits than would be provided to a magazine author or editor. Companies have learned that it's a lot better to let us know up front and in advance the issues and glitches with their printers, since they now know we will find out sooner or later on our own. They actually tell us they realize we will find out on our own anyway.

Contributions, grant, sponsorships, and project funds from these companies are also used to improve the design and appearance of the web sites of the FLAAR Information Network. We thank Canon, ColorSpan, HP, ITNH, and Mimaki for providing wide format printers, inks, and media to the universities where FLAAR does research on wide format digital imaging. We thank Epson America for providing an Epson 7500 printer many years ago, and Parrot Digigraphic for providing access to their digital equipment, also for providing three different models of Epson inkjet printers to our facilities on loan at BGSU (5500, 7600, 7800). We thank Mimaki USA for providing a JV4 and then a Mimaki TX-1600s textile printer and Improved Technologies (ITNH) providing their Ixia model of the Iris 3047 giclee printer.

We thank 3P Inkjet Textiles and HP for providing inkjet textiles so we could learn about the different results on the various textiles. IJ Tech-





nologies, 3P Inkjet Textiles, ColorSpan, Encad, HP, Nan Ya Pepa, Oracal, Tara and other companies have provided inkjet media so we can try it out and see how it works (or not as the case may be; several inkjet media failed miserably, one from Taiwan, the other evidently from Germany!). We thank Aurelon, Canon, ColorGate, ColorSpan, ErgoSoft, HP, PerfectProof, PosterJet, Onyx, Ilford, CSE ColorBurst, ScanvecAmiable, Wasatch and many other RIP companies for providing their hardware and software RIPs.

We thank Dell Computers for providing awesome workstations for testing RIP software and content creation with Adobe Photoshop and other programs. We also appreciate the substantial amount of software provided by Adobe. As with other product loaned or provided courtesy of ProVar LLC (especially the 23" monitors which makes it so much easier to work on multiple documents side by side).

We thank Betterlight, Calumet Photographic, Global Graphics, Westcott, Global Imaging Inc. Phase One, and Bogen Imaging for helping to equip our archaeological photo studios at the university and its archaeology museum in Guatemala. Heidelberg, Scitex, CreoScitex (now Kodak) and Cruse, both in Germany, have kindly provided scanners for our staff to evaluate.

We really liked some of the results whereas some of the other products were a bit disappointing. Providing samples does not influence the evaluations because the evaluators are students, professors, and staff of Bowling Green State University. These personnel are not hired by any inkjet printer company; they were universities employees (as was also true for Nicholas Hellmuth). The testing person for the HP ColorPro (desktop printer) said he frankly preferred his Epson printer. When we saw the rest results we did not include this Hewlett-Packard ColorPro printer on our list of recommended printers, but we love our HP DesignJet 5000ps so much we now have two of them, one at each university.

Sometimes we hear horror stories about a printer. The only way we can tell whether this is the fault of the printer design, or lack of training of the operator, is to have the printer ourselves in-house. Of course some printer manufacturers don't understand the reasons we need to have each make and model; they are used to loaning their demo units for a week or so. That is obviously inadequate for a serious review.

Some of the media provided to us failed miserably. Three printers failed to meet common sense usability and printability standards as well (HP 1055, one older desktop model (HP Color Pro GA), and one Epson). Yet we know other users who had better results; maybe ours came down the assembly line on a Monday or Friday afternoon, when workers were not attentive. One costly color management software package was judged "incapable" by two reviewers (one from the university; second was an outside user who had made the mistake of buying this package).

So it's obvious that providing products or even a grant is no shield from having your products fail a FLAAR evaluation. The reason is clear: the end user is our judge. The entire FLAAR service program is to assist the people who need to use digital imaging hardware and software. If a product functions we find out and promulgate the good news. If a product is a failure, or more likely, needs some improvement in the next generation, we let people know. If a product is hyped by what an informed user would recognize as potentially false and misleading nonsense, then we point out the pathetic discrepancies very clearly.

This is what you should expect from an institute which is headed by a professor.

Actually, most of our reviews are based on comments by end users. We use their tips to check out pros and cons of virtually every product we discuss. You can't fool a print shop owner whose printer simply fails to function as advertised. And equally, a sign shop owner who earns a million dollars a year from a single printer brand makes an impact on us as well. We have multiple owners of ColorSpan printers tell us that this printer is their real money earner for example. We know other print shops where their primary income is from Encad printers. Kinkos has settled on the HP 5000 as its main money maker production machine, and so on.

Yet we have documentation of several print shop companies whose business was ruined by specific brands that failed repeatedly. It is noteworthy that it is always the same brand or printer at both locations: one due to banding and printheads then simply no longer printing one color; the other brand due to pokiness of the printer simply not being competitively fast enough. Same with RIPs, we have consistent statements of people using one RIP, and only realizing how weak it was when they tried another brand which they found substantially better. Thus we note that companies which experiment with more than one brand of product tend to realize more quickly which brand is best. This is where FLAAR is in an ideal situation: we have nine RIPs and 25 printers. Hence it is logical that we have figured out which are best for our situation.

Grant funding, sponsorship, demonstration equipment, and training are supplied from all sides of the spectrum of printer equipment and software engineering companies. Thus, there is no incentive to favor one faction over another. We receive support from three manufacturers of thermal printheads (Canon, ColorSpan and HP) and also have multiple printers from three manufacturers of piezo printers (Epson, Seiko, Mutoh, and Mimaki). This is because piezo has definite advantage for some applications; thermal printheads have advantages in different applications. Our reviews have universal appeal precisely because we feature all competing printhead technologies. Every printer, RIPs, inks, or media we have reviewed have good points in addition to weaknesses. Both X-Rite and competitor GretagMacbeth provided spectrophotometers. Again, when all sides assist this program there is no incentive to favor one by trashing the other. Printer manufacturer ad campaigns are their own worst enemy. If a printer did not make false and misleading claims, then we would have nothing to fill our reviews with refuting the utter nonsense that is foisted on the buying public.

It is not our fault if some printers are more user friendly, print on more media than other brands. It is not our fault that the competing printers are ink guzzlers, are slow beyond belief, and tend to band or drop out colors all together. We don't need to be paid by the printer companies whose products work so nicely in both our universities on a daily basis. The printers which failed did so in front of our own eyes and in the print shops of people we check with. And actually we do try to find some redeeming feature in the slow, ink gulping brands: they do have a better dithering pattern; they can take thick media that absolutely won't feed through an HP. So we do work hard at finding the beneficial features even of printers are otherwise get the most critique from our readers. Over one million people will read the FLAAR Information Network in the next 12 months; 480,000 people will be exposed to our reports on wide format printers from combined total of our three sites on these themes. You can be assured that we hear plenty of comments from our readers about which printers function, and which printers fail to achieve what their advertising hype so loudly claims.

An evaluation is a professional service, and at FLAAR is based on more than 11 years of experience. An evaluation of a printer, an ink, a software, laminator, cutter or whatever part of the digital printing workflow is intended to provide feedback to all sides. The manufacturers appreciate learning from FLAAR what features of their printers need improvement. In probably half the manufacturers FLAAR has dealt with, people inside the company did not, themselves, want to tell their boss that their pet printer was a dog. So printer, software, and component manufacturers have learned that investing in a FLAAR evaluation of their product provides them with useful return on investment. Of course if a printer manufacturer wants only a slick Success Story, or what we call a "suck up review" that simply panders to the manufacturer, obviously FLAAR is not a good place to dare to ask for such a review. In several instances it was FLAAR Reports that allowed a company to either improve their printer, or drop it and start from scratch and design a new and better one.

And naturally end-users like the opportunity to learn about various printers from a single source that covers the entire range from UV through latex through all flavors of solvent.

We have also learned that distributors often prefer to accept for distribution a printer or other product on which a FLAAR Report already exists.

We turn down offers of funding every year. These offers come from PO Box enterprises or products with no clearly visible point of manufacture. Usually the company making the offer presumes they can buy advertising space just by paying money. But that is not what our readers want, so we politely do not accept such offers of money.

Contributions, grants, sponsorships, and funding for surveys, studies and research is, however, open to a company who has an accepted standing in the industry. It is helpful if the company has a visible presence at leading trade shows and can provide references from both end users and from within the industry. Where possible we prefer to visit the company in person or at least check them out at a trade show. Obviously the product needs to have a proven track record too. Competing companies are equally encouraged to support the FLAAR system. We feel that readers deserve to have access to competing information. Competition is the cornerstone of American individualism and technological advancement.

FLAAR also covers its costs of maintaining the immense system of 8 web sites in three languages and its facilities in part by serving as a consultant such as assisting inkjet manufacturers learn more about the pros and cons of their own printers as well as how to improve their next generation of printers. It is especially useful to all concerned when manufacturers learn of trends (what applications are popular and for what reasons). For example, manufacturers need to know whether to continue designing software for Mac users, or concentrate software for PC users. So the survey form that you fill out is helpful to gather statistics. You benefit from this in two ways: first, you get the FLAAR reports in exchange for your survey form. Second, your comments bring (hopefully) change and improvement in the next generation of printers. When we do survey statistics, then the names, addresses, and telephone numbers are removed completely. A survey wants only aggregate numbers, not individuals. However, if you ask about a specific brand of printer, and do not opt out, we forward your request to a pertinent sponsor so you can obtain follow-up from that brand, since we ourselves do not have enough personnel to respond to each reader by telephone. But we do not provide your personal information to outsiders and our survey form has an opt out check-off box which we honor.

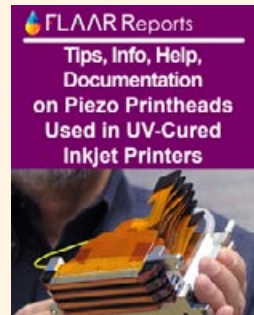
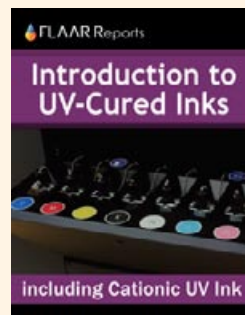
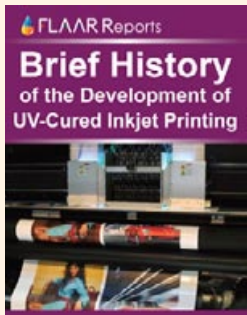
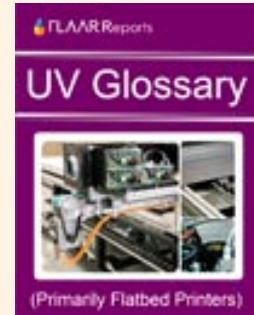
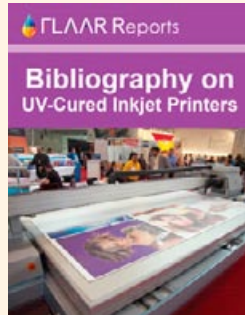
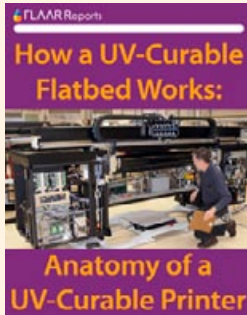
FLAAR also serves as consultants to Fortune 500 companies as well as smaller companies and individuals who seek help on which printers to consider when they need digital imaging hardware and software.

A modest portion of our income comes from our readers who purchase the FLAAR series. All income helps continue our tradition of independent evaluations and reviews of inkjet printers, RIPs, media, and inks.

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Comments on UV Inkjet Printers at Major Trade Shows 2007-2009



UV Printers Manufactured in China, Korea and Taiwan

