



What to Expect in 2008

Solvent & UV Wide-Format Inkjet Printers



Nicholas Hellmuth

Introduction

For the past several years we have issued a “What to Expect for 2005” and then “What to Expect in 2006.” Then we expanded this into two separate reports: “What’s New in Water-Based Printers in 2007” and the present “What to Expect in 2007 from Solvent and UV Printers.” Now for 2008, these are being updated.

This is intended as an introduction and thus is part of our free publications. If you wish additional information on specific printers, many of our reports on signage printer trade shows are also at no cost. The reports on the high technology printers, such as UV, have a small charge to help us cover the costs of getting to the trade shows, seminars, etc. It cost us about \$38,000 last year, for airfare (economy), modest hotels, and meals (definitely not lobster). No university would pay for a professor to attend all these programs. These costs do not include all the other expenses involved in preparing a report, such as editor, graphic designer, etc. So the FLAAR Reports are at a fair price.

In all rapidly advancing technology sectors there is what is called a “Non-Disclosure Contract.” So when we visit an ink chemical company, they ask us to sign an NDA that states we will not publish facts on their ink formula nor will we publish details on their next new ink that is coming out in six months. So we often know about half the new products before they actually are announced but we are discrete about what we are allowed to reveal, and when.

We only write about future products when these products are officially released, or, if before release, only when a pre-release product is already openly discussed and is thus obviously no longer a trade secret. Usually about half the new releases become common knowledge several weeks before official launch. Of course there are a few errors in the grapevine too. So it was a relatively common rumor in early 2007 that Inca would eventually produce a 4x8’ flatbed. That’s no trade secret if everyone is talking about it already. Plus it is logical, because they have to produce one of this size to compete with Gandinnovations new 4x8’ UV flatbed and the new Oce model 250 GT, etc. Naturally many rumors are incorrect... and Inca has not yet released any 4x8’ flatbed.

But another rumor turned out to be correct, that DuPont would drop out of the UV printer market for two reasons: the repair and tech support costs of maintaining the Chinese-made UV printers was too high, and profits from the UV printer and ink business was not as high as anticipated. It was also rumored that the ink claimed to be “DuPont ink” was actually not entirely their ink. All this information was readily available long before SGIA, when the DuPont booth space was empty and turned into a café by SGIA to try to obscure the fact that DuPont had pulled out. This pullout is unfortunate, since their UV printer development team had worked very hard. Unfortunately reality is hard to overcome. All you needed to do to experience reality was to ask anyone who owned one of these printers.

Most of the predictions by the FLAAR research institute are based on years of experience and knowledge that allow us to calculate what is going to happen because our basic understanding of the overall world market. For example, you don’t need to break any NDA to know that Roland, Seiko, and Mutoh will need to produce a UV-cured inkjet printer during early 2008. If their UV printers are not shown by DRUPA, they are out of the race. They may even show them at ISA or at FESPA Digital, before DRUPA.

So “What to Expect that’s New” is based on common sense, on those products that don’t have any NDA, and on those products already widely discussed in the industry although not yet officially revealed to the public.

What to Expect in 2008 Eco-Solvent, Solvent, Mild/Lite-Solvent

Franchise print shops, small family-owned sign shops and many other kinds of print shops are still buying solvent, mild-solvent, and eco-solvent printers around the USA, Canada, and Western Europe. So Roland still survive selling their various flavors of solvent printers.

Sign shops in most of Asia (especially Korea), the Middle East, Eastern Europe, Turkey, India, and all of Latin America are all still firmly users of solvent inkjet printers, primarily full-strength solvent ink. This is where the Chinese manufacturers are doing well.

Western Europe, the UK, and the US are switching relatively fast to UV-cured inkjet printers. ColorSpan has sold more than 900 of their model 72UVR and UVX printers and launched five new models: 9840uv and four 5400uv series machines (now part of HP).. Gandinnovations, Durst, Inca, and VUTEK are all selling UV printers very well.

Water-based ink printers have been fading from the scene: Encad and Kodak disappeared totally from the wide format inkjet market over the last two years. But Canon and HP each invested a billion dollars in new water-based inkjet technologies, so there has been a brief revival, just in time before water-based printers effectively evaporate from the trade show booths.

So lets look at these three areas: solvent printers for signage, developing UV technology, and waning water-based printers. The report on water-based printers for 2008 is separate.

Solvent inkjet printers

The physical features of solvent printers have been well established for many years. So to find a revolutionary breakthrough in design is unlikely. With a solvent printer the truism is: "you get what you pay for." If you buy a cheap printer, you get a cheap printer that will wear out and break down. It will have zero re-sale value after two years.

If you buy a solid printer: Gandinnovations, VUTEK, Mutoh, Mimaki, Roland you can anticipate it will last over five years and will still have a reasonable re-sale value after three years.



Gandinnovations Jeti 3300 solvent printer



Gandinnovations solvent printer at factory visit



Structure of Gandinnovations Solvent Printer

D.G.I. and Keundo also have a good presence in this solvent ink market. Korean printers tend to be well designed but cost less than printers made in Europe, Japan, or the US.

A newer and smaller Korean company that sold printers under the Sprin name (Kwangko) evidently does not exist any more; their printers looked more like the cheaper Chinese kind of design. Chinese printers, whether solvent or UV, have innumerable issues. In other words, printers that are really designed and made in Korea tend to be acceptable; printers that have any aspect (design or manufacture) in China, even if rebranded in Korea, are not a good bet.

I have visited a large sign shop in Nevada that has several Keundo liquid laminators and a Keundo solvent printer, and he is content with them all. You see D.G.I. printers all over the world too. If someone wants more dpi, then they buy a different brand, but if you want a lower priced solvent printer that is okay, Korean workmanship is definitely better than what has come out of China in the last several years. I have visited the D.G.I. R&D facility in Korea. They have their own research institute, indeed they make their own equipment. This facility was larger and more sophisticated than most other solvent printer companies that I have visited.



Dr Nicholas Hellmuth visit Dilli headquart in Korea in 2007

Of course this will change; eventually Chinese printers will be better. But so far, for 2008, only one or two brands are even barely acceptable. Look at Redhill, Gerber, 3M, Matan, B&P Lightbrigade, and DuPont: they all tried to sell Chinese solvent printers and gave up since the quality was not consistent and tech support was not up to expected levels.

FLAAR offers its reports on solvent ink printers on www.wide-format-printers.net. During 2004-2007 our reports were primarily on the rapidly developing field of UV-cured inkjet printers, but we also produced several reports each year on specific Mimaki, Mutoh, and Roland printers. Being able to spend an entire week inspecting and testing printers at the Mutoh Europe factory in Belgium facilitated three new reports during 2007 especially their new Intelligent Interweaving software technology. If it becomes possible to visit the Roland headquarters and demo center it would be possible to issue more reports on this brand, but in the meantime we have issued a site-visit case study of the Roland AJ-1000.

In the future we will have a report on the new Mimaki solvent printers such as their JV5, but the early versions were plagued by problems with the ink, especially the inability of the system to dry the ink successfully. This same issue has blemished other new Mimaki solvent printers as well. Perhaps in 2008 whoever is supplying the ink (it must come via Epson) will resolve these issues and we could then do a full evaluation. Or perhaps Mimaki will eventually realize (as Roland did already last year) that Epson wants the signage market for itself from 2008 onward; in other words, Mimaki might want to move faster to develop printers with printheads other than from Epson.

First lets define the options in solvent ink:

- Solvent ink has cyclohexanone, roughly 13% (varies per formula).
- Mild solvent and lite solvent are poorly defined but essentially mean the same thing: this ink has no cyclohexanone (in most but not all cases).
- Eco-solvent ink attempts to be without noticeable odor.

Eco-Sol, the third generation eco-solvent ink, is about \$60 a 220 cartridge. Roughly, that's about \$250 a liter. UV-curing ink varies in cost from about \$190 a liter to \$225 a liter. Only in unusual cases is the ink as high as \$250 a liter: I know of only one brand at that high a price (the cheaper the UV printer hardware is, the more expensive their ink is).

But what counts is not the cost-of-ink-per-liter, but the cost-of-ink-per-print. UV-cured ink machines use less ink. UV-cured printing has no solvents to drive off; UV ink is pure ink (more or less, but the point is that you don't need as much UV ink to do the job). Once sign shops realize that UV ink is cheaper than eco-solvent ink, more will start thinking about switching. NUR already offers a UV-curing roll-fed system, Expedio Revolution, where the UV printing costs are comparable to, or less than, printing with solvent ink.



NUR Expedio Inspiration 3200 UV printer, with flatbed and roll-to-roll option.

Advances in Ink Chemistry

UV ink and solvent ink are where most advances will take place during 2008. Cationic chemistry is gradually becoming available for UV-curing systems. Previously all UV-cured flatbed used free radical photo initialization. If these terms are just jargon to you, it would be worth attending one of the UV seminars sponsored by IMI (www.imiconf.com). Unfortunately cationic UV ink does not work in most instances: look at the FLAAR Report on the Gerber ion, the only printer in the world that attempts to use cationic UV ink.

The misleading eco-solvent concept will gradually be replaced by stronger inks that are really closer to mild-solvent or lite-solvent; since no ink was ever really ecological. In general, inks get dramatically better every two years. The reason is that ink companies and printer manufacturers get most of their profit from selling this colored water.

Once people realized that eco- inks were not very ecologically friendly, manufacturers tried to pretend they were “eco=nomical.” This is a farce, since they were never cheap. These new inks are simply less obviously carcinogenic.

An attempt at improvement in eco-solvent and/or mild-solvent inks came from Agfa. It is typical that what used to be a wimpy eco-solvent has now evolved into a stronger and thus better ink, but by this very change becomes closer to what is called mild-solvent (also called lite-solvent). Unfortunately this ink did not work well with Epson heads and caused the entire Agfa entry into solvent ink printers to fail. Agfa withdrew totally from all kinds of solvent ink, and switched completely to UV inks. Unfortunately it's first generation UV printer also failed (in 2005), so it is rebranding UV printers made in Korea (since they are more reliable than anything made in China).

One of the best new solvent inks for 2007 was by one of the grand-format ink manufacturers. We will write more about this later in 2008 when it is formally announced and readily available.

Aftermarket Bulk Solvent Ink

When we inspect sign printing companies, about half report serious issues when trying to use after-market ink. In these cases (with Mimaki JV3 printers, for example), they switched back to the original ink from Mimaki.

One issue with after-market ink is that you never know where it comes from. For this reason we prefer after-market ink that comes from a well-established company that you can find both in the US and in international trade shows around the world. One company in this category is Triangle. This comment does not mean their, or any ink, is perfect, but to state that we know the company and its name and ink is respected worldwide. Indeed Triangle UV ink is used in some Chinese UV printers that are sold in the US. Another company whose after-market ink we have inspected is Bordeaux. There is a separate FLAAR Report on their ink. I have also visited the ink development labs, testing center, and ink production factory of Sun LLC in Novosibirsk, Russia (no relation to Sun Chemical in England). There is a FLAAR Report on Sun LLC available at no cost: all these reports are on the Free Downloads page on www.wide-format-printers.NET. The link is in the vertical column of links at the right.

What to expect in eco-solvent, mild-solvent, and full solvent

There will be only a few new mild-solvent printers in the 54-74 inch range during 2008. That's because so many new printers already came out in 2006-2007. But it takes more than just a "new printer" to be a success. So positioning, and marketing these new printers, will be a challenge since ColorSpan (before it was bought by HP) dramatically announced it is lowering the prices on their UV printers substantially. These are the largest price drops in a UV printer line in recent history. Every person that buys a UV printer is less likely to buy another solvent machine.

At present, from the current crop of mild-solvent printers, the one that set sales records in 2004-2005 was from Seiko, their ColorPainter 64S. Seiko is a solid company (it owns Epson). HP took over sales of the Seiko printer in 2006, now rebranded as the HP Designjet 9000s. A lower priced version, the HP 8000s, was introduced but was quickly withdrawn and postponed (and then re-introduced). Then sales of the HP 9000s version of the Seiko ColorPainter collapsed, since this is essentially a rebranded Seiko 64S with the notable new aspect being a higher price. The Mimaki JV5 and new Roland printers outsold the HP version of the Seiko. This is iconic, since the original Seiko version set sales records and was beginning to outsell the Mimaki JV3. Yet this older Mimaki JV3, still in 2006 and into 2007, is selling acceptably. During the reign of the Seiko ColorPainter 64S, Seiko took over sales in the mild-solvent classification, especially in the US. One reason is that the Seiko ColorPainter 64S was successful in FLAAR evaluations.

In addition to the FLAAR Reports evaluation review on the Seiko there was a second FLAAR Reports from a site-visit. Many people who bought the Seiko said it was because of the documentation from FLAAR. But we don't yet have many reports on the HP 9000s, the HP 10000s, or the HP 8000s, in part because none are readily available near our office in Ohio. Plus Mimaki and Roland understand sign shops better, so can better market and target their solvent printers to sign shop owners.



Mimaki JV5 solvent printer at Viscom Germany 07

Now Seiko lost most of their special distributors (since there were no more Seiko solvent printers, so HP switched the new version to already established HP dealers). So now, even if there were to be any new Seiko-branded printer (such as a new UV printer), Seiko would not have many distributors remaining.

Xerox reputedly attempted to create a mild-solvent printer, the “ColorgrafX X3,” but either the collapse of XES division or other factors resulted in no such printer being shown at DRUPA (May 2004). So Xerox rebranded the water-based Encad 1000i and sold this as though it were a Xerox printer, the Xerox 8160 and Xerox 8142. But these are not solvent ink machines and have all the quirks of an Encad NovaJet. Then Kodak was not able to keep Encad alive. So Xerox has temporarily switched to rebranding a Mutoh eco-solvent printer for signage. Because it has no inkjet technology of its own, Xerox has not done well with inkjet technology. But at least Xerox has not made any blunders the magnitude of Kodak.

In the previous decade Kodak had bought the remains of the CrystalJet piezo printhead technology (after it had failed in blazing collapse). Kodak then had the next most expensive failure in inkjet printer history: their own Kodak 5260. Then Encad melted down under Kodak management. Then Kodak tried to salvage the last Encad internal dream-printer project; this was abandoned by summer 2007 after realizing they could not possibly compete against HP, Canon, or even compete against the smaller Epson. Xerox’s failures were primarily earlier, with electrostatic printer technology and their Colorgrafix oil-based printers via Olympus.

Success or failure in developing a new product depends on which partner(s) you pick. This is why FLAAR is now offering consulting services, so we can assist companies to avoid the mistakes of the past. Since FLAAR does not belong to, and is not owned by, any manufacturer, we have a more realistic view of the pros and cons of each product, each technology, and each company.

Roland has a 100-inch solvent printer, the AJ-1000 using industrial piezo printheads (from Seiko, not from Epson). Print quality is not as good as the Seiko ColorPainter 64, which uses Konica heads. But print quality is probably a tad better than Xaar heads and probably a few seconds faster than using Epson heads. There is a separate FLAAR Report on the Roland AJ-1000, based on inspecting it over several months at a printshop.



Roland Advanced Jet AJ-1000 solvent printer at FESPA 07

Oce, probably no more of their own solvent printers

We like Océ products in general and hope they can come out with something new and innovative in solvent ink for 2008. Some of the older Arizona printer concepts date back to the 1990's. Otherwise the low-price Chinese, Taiwan, Korean, and Japanese companies will continue to trample the slow and high-priced Arizona solvent models one by one.

Since the Océ Arizona 500 and Océ Arizona 600 did not sell well, it is unlikely that Océ will attempt to compete with D.G.I., the Chinese mass of cheap printers, or the popular Mimaki, Roland, Gandinnovations and other prestige brands. Thus I doubt that Océ will attempt to develop any more of their own solvent ink printers in 2008. They will concentrate on popularizing their new UV printer, the 250 GT. Relative to solvent printers for 2007, Océ will continue to rebrand Mutoh printers. In some countries Océ also sells Gandinnovations Jeti solvent printers (Canada, France, etc).



Océ Arizona 600 Solvent printer at SGIA 04

Mutoh, Mimaki, and Roland

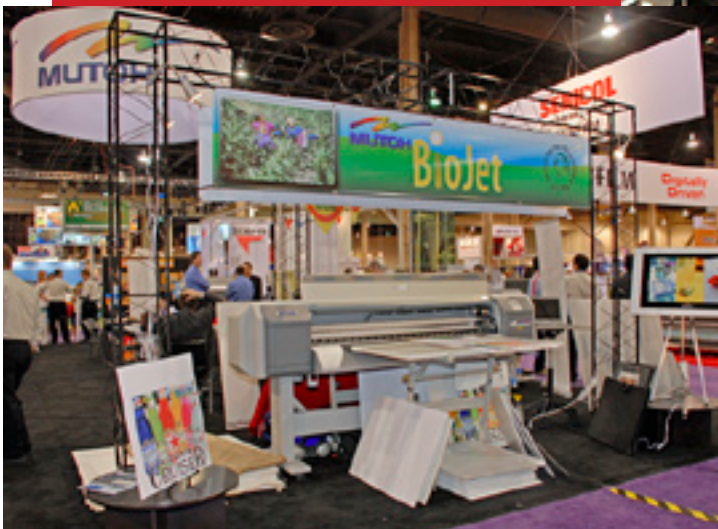
These three companies introduced so many new solvent printers in 2005-2007 that anything else for 2008 would mainly be stretch models (wider versions of printers that already exist) or versions with printheads other than from Epson. One innovation we are looking at closely is Mutoh's new software. Remember, a printer is a chassis and printhead carriage; without software it can't do anything. Software is the brains of the printer. Better software is often more important than hard-wired features. This is another reason why Chinese printers don't fare so well; their firmware is weak.



Mimaki booth at FESPA 07



Roland booth at SGIA 07



Mutoh booth at ISA 07

Mutoh has been doing acceptably, in large part due to the success of their Intelligent Interweaving software. And a key aspect of the success of this innovative software is that the FLAAR Reports on this software has been downloaded by over 49,000 printshop owners and printer operators during 2007 and early 2008. I spent an entire week at the Mutoh Europe headquarters in Oostende, Belgium, testing this software. I also checked with other industry consultants about this software. They each independently acknowledged the capability of this unusual feature (that only Mutoh offered).

The best documentation of the effect of the Intelligent Interweaving of Mutoh is that Roland has come out with its own "Intelligent Pass Control Technology." So far there are not yet any FLAAR Reports on this because we have not seen it anywhere yet.

Roland is very popular, especially in Europe (and particularly in Italy, Greece, and a few other countries). In Latin America the primary solvent printer brand used to be D.G.I. but is now Infiniti.



*Dr Nicholas Hellmuth at the Mutoh factory study the printer technology.
Mutoh Rockhopper eco-solvent printer*

The Ripple Effect of Epson introducing an eco-solvent printer in 2008

Five years ago Epson already was preparing to enter signage markets and produce a 64-inch printer. Mutoh, Mimaki, and Roland are also aware of this cannibalistic aspect of Epson. From 2000 onward, Epson made only 24" and 44" printers, and left the signage market (60" and wider) open to Mimaki, Mutoh, and Roland.

During 2000-2002 Roland was the leading printer for giclee and fine art photography. Then Epson decided it wanted that market and did not allow its printheads to be used by Mimaki, Mutoh, or Roland in the giclee or photography market after that. By 2005 hardly anyone was buying any of these non-Epson brands for giclee; everyone was using an Epson or an HP 5500.

Now the same will happen once Epson produces a 64" solvent printer. This will cannibalize the market for Roland, Mimaki, and Mutoh solvent printers that use Epson heads.

Overall the benefits for end-users will be considerable: Epson heads were never really made to handle solvent inks. The first retrofitted solvent ink printers were inadequate in almost every respect. So when Epson does come out with a solvent printer of their own, this will force Mimaki, Mutoh, and Roland to use stronger more industrial-strength printheads.



Epson Stylus Pro 11880 printer at SGIA 07

Now you know why the Roland AJ-1000 uses Seiko heads instead of Epson heads. Roland realizes that Epson wants to do to the signage market what Epson did with water-based inks to the giclee and proofing markets: Epson first took this market away from Mimaki, Mutoh, and Roland by prohibiting these other companies from aiming their own Mimaki, Mutoh, and Roland water-based printers for giclee, photography, or proofing. Between 1999-2001, Roland was the leading brand for giclee ateliers (for those printshops that did not use an Iris or ColorSpan). But by 2002 Roland and Mutoh had to enter the eco-solvent market to replace sales lost to Epson in the water-based printer markets.

Once Epson took over the giclee and photo printing markets from Roland, Epson took over these markets from HP (HP had no printhead with small picoliter drop size in those years). Then Epson took over the proofing market from HP.

Now Epson wants to follow a similar battle plan for the signage market: first take over from Mimaki, Mutoh, and Roland, then take over from HP/Seiko.

Of course this move by Epson into solvent ink may backfire: an Epson solvent printer will encourage Mimaki, Mutoh, and Roland to accelerate their dropping Epson heads. Once these three brands no longer use Epson heads, they no longer have to buy ink from Epson. So Epson will lose a huge tithe from ink sales; currently every Mimaki, Mutoh, and Roland that uses an Epson printhead pays a "tax" to Epson on the ink. Once the Mimaki, Mutoh, and Roland printers no longer have to pay Epson, their ink will be more price competitive.

But Epson's main problem will be reliability: sign shop owners won't put up with a cheap printer that wastes ink like the Epson 9600 or Epson 9800.

Epson's other issue will be its image: Epson knew how to interact with giclee ateliers and with photographers. HP was too staid, too office-oriented (like Océ and Xerox). HP booths were too "corporate," too inflexible. Only when the HP booth was designed by Squirt Printing could they compete with Epson in the world of art.

Now Epson faces a comparable issue in the world of signage: printshop owners speak a different language than giclee ateliers in the art world. It's a definite benefit that FLAAR comes from the world of anthropology and art both: we know how to study cultural differences (from our anthropological background). And we know art from being in this world. The last eight years we have also been in the world of wide-format inkjet printers for signage.

Considering that Epson sales collapsed after the Canon iPF series was introduced, and that Epson sales tanked again after



Epson Stylus Pro 7880

HP introduced its Z-series, it is understandable that they realize the glory days of profits from water-based printers are over. Unfortunately Epson is moving into solvent printers precisely when use of solvent is also declining (as HP found out painfully when HP took over sales of Seiko ColorPainter solvent printers, only to see sales of the HP version plummet downward quickly).

So 2008 will be an interesting year for seeing how market shares rise, and others collapse. Since a substantial portion of market share is based on FLAAR Reports, we are dedicating more expertise to understanding the pros and cons of each printer. By the time you read this, FLAAR will have spent an entire week inside the main Mutoh-Europe factory where many of their solvent printers are designed and built. No trade magazine can invest in this much time and dedication to learn about the printers inside out. FLAAR, since it is non-profit, is more interested in finding the truth about printer reliability.

A trade magazine would lose advertisers if it reported everything that malfunctioned in each brand of printer.



HP Z2100 printer



HP Z3100 printer

What you will see in 2008 solvent printers is better ink, improved printheads

Probably the main improvements in hardware for 2008 will be the printheads. More and more manufacturers are dropping the cheaper Epson heads and the problem-prone Xaar heads and trying out more robust Spectra printheads. Some companies may experiment with Ricoh, Konica, or Seiko printheads, but the actual performance of those last two is unknown; there are not yet enough feedback from how well they hold up. Ricoh heads have been used by the ColorSpan solvent printer and now the ColorSpan UV machines. Although most printer manufacturers are experimenting with Konica and Seiko heads, I know of one major manufacturer that is also testing Ricoh heads for their solvent and UV printers.

Ricoh now offers double the nozzles and also variable droplet size on its printheads. Spectra offers MEMS technology heads. Konica and Seiko heads also improve, but not enough machines use those last two brands in solvent printers to know as much about them. The issues of Xaar heads are legendary since so many companies used them several years ago. Three things have keep Xaar alive financially:

- Agfa put a lot of money into Xaar (especially during 2004-2005), trying to develop cluster arrays of Xaar heads. Unfortunately the Agfa :Anapurna UV printer failed (probably for many other reasons besides the Xaar heads).
- Chinese printer manufacturers still buy Xaar heads, but most have switched to Konica or Spectra heads in the last two years.
- License fees from Toshiba Tec, Konica, Seiko and other companies that need to license the patents from Xaar in order to be able to build their own printheads.

MEMS technology heads are on the future horizon (at least HP Scitex, Spectra and also Kodak all hope so). HP Scitex is trying out their own X2 MEMS heads in products this year. But again, too few of these new printers are out there, so the reliability of the heads is not yet known (other than that the X2 printheads have a high failure rate during manufacturing and the ones that survive manufacturing last about four months when in full-time usage). This kind of helpful information is why a quarter of a million printshop owners, managers, printer operators, and people in the industry read FLAAR Reports.

So it is unsure how these heads can be manufactured to needed tolerances, since it's very new technology. CrystalJet had new head technology in a previous era, but they could not be manufactured easily, and that technology died out (Kodak bought what was left of it).

So if you are impressed with fancy new technology, better find a print shop that is using MEMS technology printheads and find out if they still function after the first 8 months of intensive use. So far Spectra MEMS heads have the best reputation.

On the new inks, I am under NDA on which companies are coming out with new inks, but the one new solvent ink I have seen (grand format category) is a mild-solvent. The print shop that is using it says it's vastly better than the original true solvent because of the lack of noticeable smell. This is one of the first grand format (super-wide) printers to use a mild solvent ink. Previously, the larger the printer the harsher the ink.

Bio-solvent ink is not yet used by enough people to know its actual pros and cons. Bio-solvent ink is made by InkWare (VUTEk, part of EFI). FLAAR has published articles on Bio-solvent ink in several trade magazines.

Better heaters

In the beginning eco-solvent printers were just retrofitted water-based printers. That's a polite way of describing them. In reality the early eco-solvent machines were jerry-rigged water-based printers. The first two generations of ink were awful and the heaters were not enough, not even for the inadequate ink chemistry.

As the eco-ink got better, it had to be "stronger," in other words, closer to mild-solvent ink formulations. This called for even more heaters and/or dryers. So gradually more heaters were built onto the cheaper solvent printers. But poor or insufficient heating is still an issue on many machines. That's why most printshops have to buy an add-on heater. This add-on heater has its own legs; you roll it up to the printer to help the solvent chemicals to evaporate so the ink will be better fixed into the substrate.

Technology breakthroughs have been lacking in solvent inkjet heaters, but at least gradually people are realizing that the wimpy heaters that come on the chassis are usually inadequate.

Conclusion on solvent printers

Increasingly sign shops are buying solvent printers to replace their trusty Encad, ColorSpan DisplayMaker and HP 5000/HP 5500 machines. Thermal printheads and water-based ink produced great backlit signage, as does Durst Lambda and Oce LightJet still today. UV-cured output is less grainy and has an improved color gamut over last year, but putting a light behind a UV print emphasizes whatever handing and residual graininess remains. So for backlit, solvent ink had a window of opportunity in past years.

But by 2008 UV technology will have improved to the point that more and more backlit, such as at bus shelters, can use UV. The people shivering inside a bus shelter, or roasting from the summer heat, are not going to complain about the image quality as much as inside a perfume store or name brand boutique. Along Madison Avenue in New York, along Bahnhofstrasse in Zurich, or throughout capitals of consumerism such as Dubai, Tokyo or Seoul, clients (and viewers) will still demand the backlit quality that only a LightJet, Lambda or high resolution water-based printers can produce.

But for gas stations and supermarkets, solvent-based backlit prints are gaining popularity, especially with printers that can print on both sides, such as the double-system of Gandinnovations. FLAAR will initiate reports on backlit printing later this year.

What to Expect in 2008 for Flatbed & Roll-Fed UV-cured Inkjet Printers

First, expect lots of new models of UV printers at FESPA Digital 2008 in Geneva and DRUPA '08, of several kinds.

There will also be one more Korean manufacturer of UV printers (to add to the many already making UV printers).

There are many differences between solvent ink markets and UV printers. Solvent ink technology is relatively stable; not many new breakthroughs. In the world of UV printing, everything is new every few months. Major breakthroughs in inks, in curing lamps, in materials, in feeding the material all result in newer better faster more economical UV-cured wide format inkjet printers.

Oce

By the time of CeBIT 2001 we learned that Oce had their own printer in development. This printer went through countless modifications over the years. By late 2002 it was an oil-based printer. But since this market never took off (as XES and Seiko found out), by late 2003 the Oce prototype morphed into a UV-curable inkjet printer. And at Graphics of the Americas it was first shown widely to the American public as the Arizona 60UV. We discuss this in more detail in the FLAAR Series on flatbed printers with UV-curable ink. By January 2005 the Oce 60UV was no longer in their product list. \$40,000 was just too low a price to provide satisfactory performance. The printer did not have enough features and the chassis was never originally intended to handle thick and rigid materials. Plus the printer was too slow.

Then Oce dropped their Arizona T220UV printer. Not because it was bad, but because it was slow and could not compete with Gandinnovations at the high end or ColorSpan at mid-range entry level.

So this meant Oce had no UV printer of their own for about a year. In the meantime, they were selling the ColorSpan 72uvx in Europe. Oce exhibited a printer at Barcelona 2007 show that they claimed was their own, but when I saw photos of it this was clearly a ColorSpan. But now that HP has taken over ColorSpan UV printers, these will unlikely still be sold by Oce during 2008.

At SGIA 2006 Oce came back into the UV market with their model 250 GT. We wish Oce success, but their company is primarily known for selling CAD printers and office copiers; the world of signage is a bit foreign to their corporate structure, and the need of UV printer for adept tech support can strain any company that is not accustomed to providing this level of tech support.



Gandinnovations Jeti 3150 UV flatbed printer at factory visit in Toronto 07



Gandinnovations 1224 UV flatbed printer at site visit in Toronto 07

In years gone by Oce exhibited at Graphics of the Americas trade show in Miami. Indeed Oce first introduced their Arizona 60uv printer at GoA 2004. But at GoA 2007 (March 2007), Oce did not have a booth and their Arizona 250uv GT printer was nowhere to be seen. Oce as an office copier company seems to be doing okay (though the competition from Canon and Xerox must be tough in that market), and Oce's wide-format inkjet printer division is on a rebound with the potential of their model 250 UV printer, but with ColorSpan at entry-level and Gandy at the high-end, it's a competitive market.



Oce 250GT at ISA 07

More Chinese UV printers

So far only Flora, Infiniti and Teckwin have seriously exhibited their UV printers at major international trade shows. All the many other mainland Chinese UV printers have been shown in the safety of a Chinese show in Shanghai. But gradually this is changing. An Anhui Liyu (Lyric) UV printer was exhibited at Sign Istanbul in December 2006. I would expect that gradually Chinese manufacturers will be more brave and show their printers outside Asia.

Showing their printers, with 24-hour a day tech support on duty in a trade show booth is fine. But by trying to sell unfinished alpha-stage machines to unsuspecting sign shops is not good publicity. Yes, it's tempting for manufacturers to try to sell their printers to bring in investment capital, but the risk is to destroy the value of the brand name.



Anhui Liyu Eureka1808 at Sign Istanbul 06

Improvements in Chinese UV printers

The UV printers made in China that we have inspected, in detail, all have issues. I estimate that over 85% of the first generation Chinese-made printers that have been sold in the US or Western Europe were returned to the manufacturer (that would be 2005-2006). So at least by now, in 2008, it should be clear what the issues are. If you read the FLAAR Reports on Chinese UV printers you can quickly learn what needs to be improved. And within another year, these improvements will gradually take place.

For example, DuPont worked hard for three years to improve the Flora printer. But they were not able to convince the Chinese manufacturer to actually make a printer that held up to full-time production, so DuPont pulled out. The fourth generation printer, Cromaprint 18uv, will be rebranded by a former distributor of DuPont and sold discretely under a non-DuPont brand name.

UV technology is sufficiently challenging that the Chinese have learned the hard way that you can't simply take a solvent printer and put a UV lamp on it and run UV-curable ink through the system. They have also learned that you can't simply copy a UV printer part by part: the sum of the parts don't work unless you understand every ramification of UV-curing chemistry.

But they are learning. The general assessment by others in the industry is that it will take Chinese manufacturers at least two years before they have enough experience to produce a UV printer that works adequately for entry level.



DuPont Cromaprint 18UV at FESPA 07

Fewer US use of Chinese manufacturers for UV printers

Just after we state there will be more Chinese UV printers and recognizing there are improvements in Chinese UV printers, we predict that there will be fewer US companies daring to try a Chinese manufacturer in 2008. This is based on the following evidence:

First, most importer/distributors in the US have had serious financial setbacks resulting from the downsides of depending on a Chinese factory. DuPont is the best example, but there are plenty of others.

Realize that it is not the country of China that is the problem; Chinese people are hardworking and fully capable. So far two Swiss-made printers failed (Luscher and Zund 250, though for Zund it was the Sericol cationic ink, not Swiss manufacturing). And the GRAPO combo printer has serious inadequacies for handling heavy rigid materials (it does okay for roll-fed substrates). So being “Made in Europe” is no automatic guarantee that a printer is flawless. Mimaki (made in Japan) solvent printers have now two years of issues with inability to dry the “Epson” ink fast enough.

Second, as a courtesy we don’t repeat what we have heard through the grapevine about several other companies who went shopping in China to see whether factories there could build their UV printers. The results were millions of dollars lost, time wasted, and inadequate products.

One company told me that they tried every significant Chinese factory and each of their resulting sample printers was totally unsatisfactory. Clearly DuPont did not understand this aspect of reality. They only saw the low price of manufacturing and the high price they could resell it for. They did not calculate the tech support costs adequately. And they did not recognize that the FLAAR Reports already listed each of the problems, one by one, clearly and succinctly. This is why FLAAR is now offering subscriptions for the FLAAR Reports on UV printers; we hope to offer systematic consulting to more manufacturers, distributors, resellers, and end-users.

If you are a US or European company and wish to select a factory to build your printer, you might want to consult with FLAAR first. We have already visited many factories in China, Taiwan, and Korea.



Sun Chemical was intelligent enough to select an experienced team of engineers to handle the building of their FastJet. FLAAR gains experience in learning which factories are best by visiting the factories, one by one. Here is Dr Hellmuth in the factory (in England) that is constructing the 3-million dollar Sun FastJet.



Here are shots of the first two machines (other than the alpha version which is already at a test site).

More Korean UV printers and Improvements too

Korean manufacturers are more cautious; they do not release unfinished UV printers. To release a printer that is returned by the buyer is not good publicity for your brand name. This is why Keundo has carefully waited. For 2007 Keundo had its long-awaited UV printer ready to launch. Unfortunately it was a hybrid, not a combo, and has not widely been exhibited in the US. This printer has one tragic flaw (which we will detail as soon as there is time to issue a full report; we hope they have corrected this by that time). So we hope to see a new concept by the time of DRUPA. Keundo did not exhibit any UV printer at SGIA 2007. Will be curious to see if Keundo is at ISA 2008.

Improvements in UV-curing inks

Two years ago, if you asked any sign shop owner, he would say that UV-curing inks had inadequate color: reds looked too orange. Greens were too yellow. Yellows were too green. Some other reds and magenta's were awful.

But earth colors have always been beautiful. Metallic colors, such as expensive watches, are great. Blue and cyan are good.

For 2007 dramatic improvements have been made in UV ink color gamut. The new Mimaki JF-1631 has the best ink gamut I have seen so far. When I visited the Gandinnovations factory in January 2007, the UV inks I saw there were beautiful. So gradually the other ink companies will also get improved color gamut, so this last issue for UV inks will have disappeared. Also for 2007 you can look forward to improved adhesion and abrasion resistance.

The most interesting developments in UV-cured inks will be thermo-formable inks: you can print on thick materials and then heat-form them to dramatic shapes. Until now the only easy way to obtain thermo-formed signage was to buy a dedicated Océ T220 solvent printer with one special ink from South Africa. Now there are four different ink companies offering thermo-formed ink for UV printers. A UV-curing printer is much much more versatile than any flatbed solvent, since solvent inks don't dry well on many materials. Instant drying is the main selling point of UV-curing chemistry.

Improvements in reliability in printheads

Essentially the same printhead progress that is being made for solvent printers goes for printheads for UV-curing flatbed printers. Currently the three most popular heads for UV printers are those from Spectra, Ricoh, and Toshiba Tec. Konica and Seiko printheads are too new to know their reliability in full-scale production printing. We know about Ricoh heads because over 900 ColorSpan UVX and UVR machines use Ricoh heads. Xaar printheads are used by Scitex Vision, Grapo, and Zund 215 (all older UV printers)..

MEMS technology heads are appearing, first from HP Scitex and then from Spectra. But Ricoh already has variable droplet capability in its new printheads, without the need for MEMS technology. These new Ricoh heads are in the four new ColorSpan UV printers: the 5400uv series. The drop size of the Ricoh heads is also dramatically smaller than the 50 picoliter drop size of the HP X2 head. Since all UV printers are moving to higher resolution since 2006, it seems a backwards step to develop a printhead with 50 picoliter drop size. But of course if the speed is umpteen times better, that may count as a positive feature. But until we can see these X2 MEMS heads in action, we are cautious (there is a new update on the HP Scitex X2 MEMS head in the FLAAR Reports on printheads for UV printers. We indicate precisely what were the issues. Too many other heads work great, and we can see this in multiple site-visit case studies as well as factory visits to Gandinnovations and other UV manufacturers around the world.



What will appear later in 2008 and more in 2009, are page-array heads. A page-array is a line of heads all the way across the entire width of the printer. The Agfa :Dotrix, Agfa-Thieme cooperation on the M Press and the FastJet (from Sun, manufactured by Inca all have page array printhead arrangements. Within a few weeks we will be in front of the FastJet for personalized training, so by later this year the FLAAR Reports will cover this impressive Sun FastJet printing technology.



Here is Nicholas with the CEO of Xaar plc, Ian Dinwoodie. Xaar is one of the top patent owners in the world of industrial piezo printheads. This all-day visit to Xaar's international headquarters at Science Park, Cambridge, England, was to learn about Xaar printheads past, present, and future. It is intensive visits such as that that allows FLAAR to learn about each aspect of what powers a UV inkjet printer (in this case the printheads).



Dr Nicholas Hellmuth went in 2007, to the Sun FastJet factory to investigate the page-array printing technology.

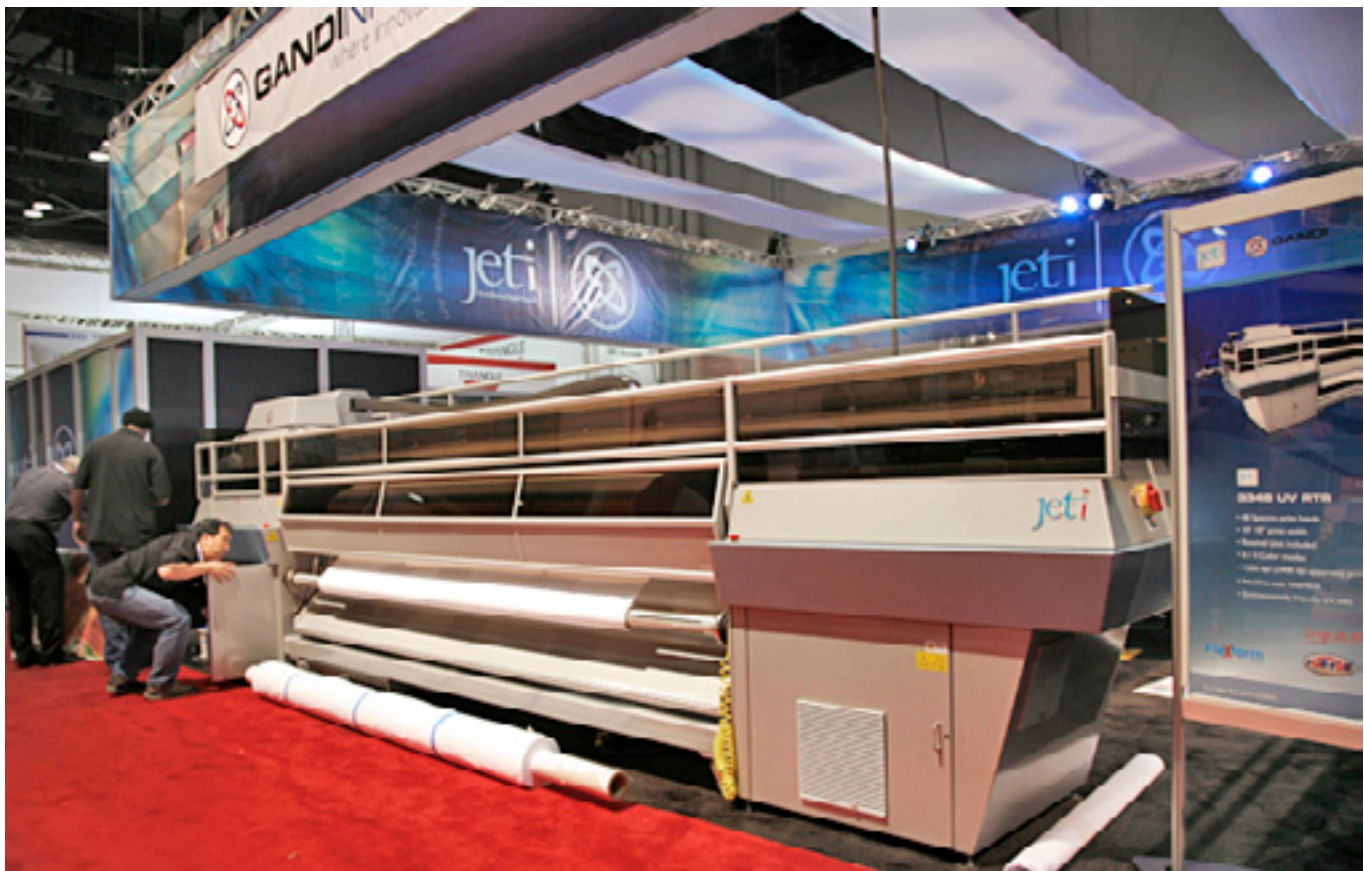
Smaller drop size and variable droplet capability

The ColorSpan 5440 uses an even newer Ricoh head with variable droplet capability. The new Spectra M-class heads have variable droplet size as well. Remember that the first Epson printers, at DRUPA 2000, did not yet have this advance. Roland was the first to develop it. Only then did Epson popularize the concept of variable droplets.

In effect, 2008 will see UV-curing printers at a comparable stage of development further along than HP and Epson exhibited at DRUPA 2000 for water-based. And by the time of DRUPA 2008, UV cured print quality will be close to that of HP, Canon, and Epson for water-based at DRUPA 2004. In other words, in a few years, UV-curing technology (and solvent inks too) will be as good a quality as water-based had reached in 2005. Already the best UV printers can match or surpass the output of an Encad printer at its best quality. The only thing that is lacking on UV-cured inks is a glossy effect, and this is only a matter of time. Or else they can jet a gloss optimizer if that is really desirable.

Improvements in lowering the heat

Improved shutters, better reflector design, and more efficient cooling systems lower the heat. The most impressive UV cooling system that I have seen so far is in the two Gandinnovations UV printers, their Jeti flatbed UV and their roll-to-roll UV.



Gandinnovations 3348 UV roll-to-roll printer at SGIA 07

Previously entry-level UV printers lacked shutters all together. This is now changed: the new ColorSpan 5400-series UV printers have shutters. Most Chinese printers lack shutters, which is why heat inside the system is causing so many issues, everything from gellation of the ink to total breakdown of the system due to massive heat stroke (so to speak).

The other way to lower the heat is to use cooler UV lamps to begin with. In the future more printers will use LED lights to pin the ink and then will do the final cure further away from the sensitive printheads.

Gerber is trying to use a UV curing lamp that operates at 40 degrees C (about the temperature of much of Greece when I visited the Athens 2005 Summer Olympics). Most UV lamps are the heat of plasma inside and boiling hot even on the outside! Unfortunately the ink company that supplied the ink does not yet have any successful use of their ink, so it's all an experiment. So far the innovative Gerber system does not work. FLAAR Reports has an entire evaluation on the Gerber ion, especially on whether cationic ink has any hope whatsoever of actually functioning as claimed.



Improvements in feeding systems

The absolute most secure method to handle a rigid, flat, or thick material is a dedicated flatbed. The best manner of moving a roll-fed material is a dedicated roll-to-roll machine. Presently Durst, VUTEk and others have primarily combo machines: a combination of flat and roll-fed capability. A moving transport belt provides the handling of the substrates through the printer. But gradually these companies will need to introduce dedicated flatbed printers. The reasons are twofold: first, once sign shops switch from solvent into UV, they start making money. Within a year or two they buy a second UV printer to handle the increased workload. If you are going to buy two UV printers, you really ought to have one dedicated flatbed and one dedicated roll-fed system.

Second, as we indicated above, dedicated flatbeds simply are better: no skew whatsoever. And probably 75 to 90% of the jobs assigned to a UV-curing printer in a typical sign shop are on flat rigid thick materials.



VUTEk QS3200 flatbed and roll fed capability

Improvements in software

There are two trends in software: for entry-level printers MacDermid ColorSpan has the most user-friendly software. We found that out when we interviewed the contented owner of a model 9840uv in Chicago. The newer ColorSpan 5400uv series also have user-friendly firmware and touch-screen interface.

Another approach is taken by Gandinnovations at grand-format size. These printers are at a high level of sophistication, so they allow their operators to tweak every aspect of the printhead, ink temperature, negative pressure and everything else. So the more complex printers allow their users to make their own changes; the more simple printing systems try to have the software do all the decisions so that operation is easy for learning the new technology. Each approach has benefits, since each of these printers is targeted at a completely different kind of audience.

More options for print shops of every size and budget

The result of all these improvements in UV-curing inkjet technology means more choice for each different size and kind of print shop. In effect, there are now over 63 models of UV-curing inkjet printers from more than 21 different manufacturers. They come in every price range from \$50,000 to over \$750,000. So although solvent inkjet printers may occupy 75% of the printer floor space at most trade shows show, digital printing technology is evolving, and the newest and most exciting technology is clearly that of UV-curable inks.

The two big shows for seeing UV printers in 2008 will be ISA in the US and FESPA Digital in Geneva, then two weeks of DRUPA in Germany. By the time of SGIA '08 (autumn), printers that were only prototypes at DRUPA will hopefully actually be capable of printing a full 8-hour shift.

Just be aware of the blunt reality of UV-curable inkjet printers:

Zund dropped out of making UV printers: they tried cationic ink and the failure of that ink cost them their sales for two years. When their printer was re-issued with normal free-radical ink, it was an excellent printer. But by then there were too many competitors with newer printers.

Lüscher, another Swiss company, tried to make a UV printer that was simply too large. Everything about it was impractical. Even though their printers were unsuccessful, at least someone is still trying to sell used Lüscher printers to unsuspecting buyers who are not aware of reality (and buyers who clearly did not read the FLAAR Reports evaluations on the issues of this printer).

We also update, revise, and add to our reports when new information is available, for example on the glitches with the ColorSpan 5440uv printers (now part of HP). We are also keeping track of how the retrofitting of these printers may resolve the issues that are for a long time publicized on user groups and signage web sites.

Many printers that have a transport belt (the combo style printers) have issues. The issues with GRAPO's belt feeding of rigid materials is the most serious, but MDO boards skew on both DuPont and VUTEK 200/600. Zund said that combo style transport belts are so unreliable that they would never again even try to use a belt of this kind in the future. On the positive side, a transport belt has some advantages over a hybrid system (pinch rollers on top of grit rollers).

Although we are not infallible, the FLAAR Reports specified the problems of the DuPont printers from Day One. FLAAR was the only resource to point out the issues with the Lüscher printer. The FLAAR Reports were the first to describe issues with curing cationic chemistry on the Gerber ion.

Currently there is no other substantive report on the issues with the Gerber ion printer and its innovative cationic ink. We would have wished that this impressive 8-million dollar initiative had been successful. But the ink chemistry and curing method selected was too much too soon (different than too little too late, but the same result). If Gerber had first offered their impressive new flatbed with free radical ink to begin with, then they could have resolved the mechanical aspects of bridging a dedicated flatbed with a dedicated roll-fed at one end. Océ was never able to make that work in two years, and they have a decade of prior experience with designing and engineering wide-format inkjet printers. Gerber has previously primarily rebranded the printers of others; only the Gerber Solara is their own wide-format concept. When Kodak's model 5240 failed, they did not ask for assistance from FLAAR until their printer was already so much in trouble that it was doomed. Actually they used the FLAAR Reports at their management meetings to indicate that they should finally be realistic and simply cancel that printer.

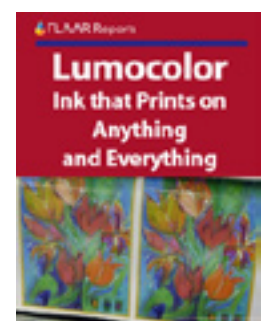
The Gerber printer could be saved (notice the past tense), if they had outside consultants (there are many excellent consultants besides FLAAR). But to keep the secrecy, they internalize everything (typical of most companies). However increasingly the other manufactures are inviting us into their R&D facilities and into their factories and to visit their headquarters in advance. This way we can discretely list the issues in private, in advance, before they show all the problems to the entire audience at their launch at a huge international trade show.

Despite occasional issues with a few models, overall sales of UV printers are rising steadily. FLAAR is interested in this technology because our university would like to have one available so their students can have first-hand familiarity, so when they apply for jobs in printshops across the country they can document they know UV-curing from first-hand experience with the printer and via FLAAR too. So in effect we are evaluating printers in order to decide which printer would be good for our faculty and our students. Once we have done all this research, we share this documentation with our readers. Since our university does not cover the research costs to visit the printer factories, trade shows, demo rooms, etc, we undertake sponsored research projects as well as ask a contribution from printshops that wish to purchase the FLAAR Reports. Fortunately the benefit of being a non-profit research institute is that we only need to cover our actual operating expenses: we don't need to make a profit or give dividends to stockholders.

Summary and Conclusion:

The real surprises of 2008 will be in addition to UV and solvent

Four years ago FLAAR began studying innovative inks; by this I mean inks other than solvent or UV. Lumocolor was the first ink that we looked at: you can request our report on this ink.



You can get this report at www.wide-format-printer.net

Then we began to hear of other inks under development, inks that were not traditional solvent and were not traditional UV either. During several months during 2007 our antennae (so to speak) had picked up chatter about quite a variety of new inks. So this is the real future: inks that are completely different. Actually you don't need to receive tips to understand that revolutionary new inks are on the horizon. Just look at the downsides of today's inks:

- Solvent ink has carcinogenic chemicals
- Eco-solvent is still not ventilation-free (despite loud claims of supporters, you must ventilate).
- Mild-solvent inks don't always get rid of all the unhealthy chemicals
- Most solvent ink requires spitting or constant jetting to keep the heads from clogging.

- UV inks use curing lamps that can melt many materials (and raise your electrical bill every month).
- When you ask a UV ink chemist about the health dangers, be prepared for a shock.
- UV ink chips off the edges when some printed materials are cut
- UV ink smudges on many materials, and does not adhere after time to others

In other words, an ink is needed

- that is not as poisonous to the environment or to the health of printshop workers.

- An ink is needed that adheres to more materials, and stays on longer

It is not appropriate to provide the specific chemicals and the names of the individual companies until each individual ink is officially released. But if you attend DRUPA 2008 (early summer) you will get much of the information. FLAAR will be at FESPA Digital the entire show, and will be at DRUPA for at least ten days.

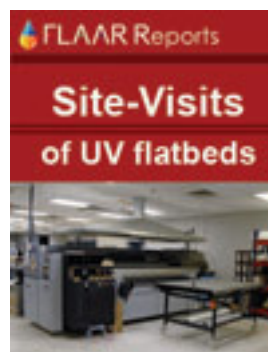
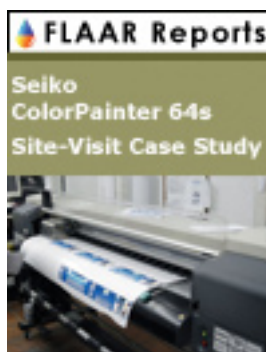
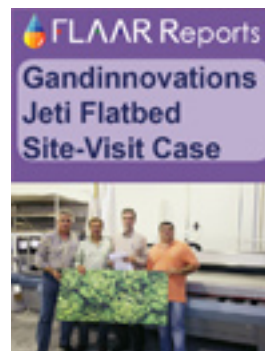
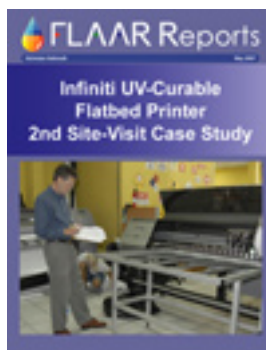
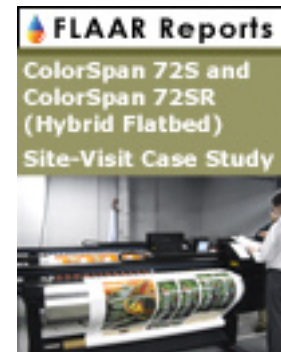
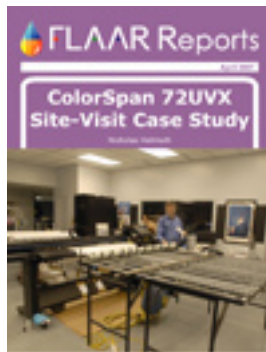
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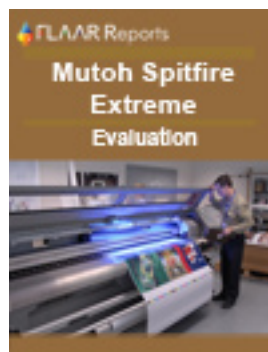
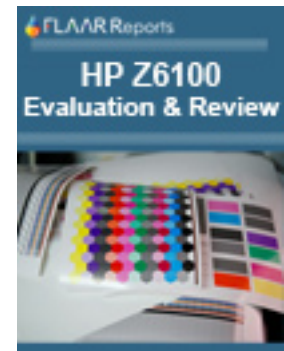
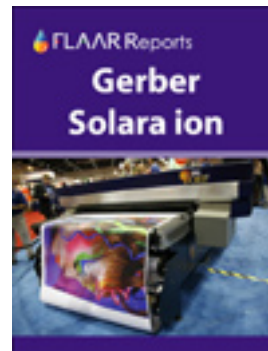
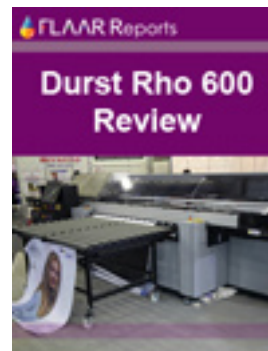
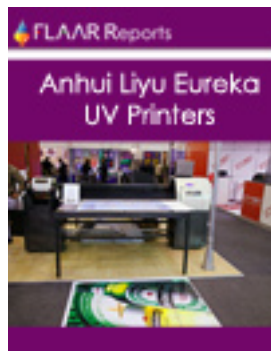
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UV-Series #1 - Introduction to UV Curable Inkjet Flatbed Printers

You can find these and more reports at: www.wide-format-printers.NET



You can find these reports at: www.large-format-printers.org



Reality Check

Being at a university absolutely 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. If in your years of wide format printing experience have encountered results different than ours, please let us know at ReaderService@FLAAR.org. We do not mind eating crow, though so far it is primarily a different philosophy we practice, 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 the university 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 49,000 of our many readers who have shared their experiences with us via e-mail (the Survey Forms).

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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. To obtain the next update write ReaderService@FLAAR.org.

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.

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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 workaround. 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, usually 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 courses 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.

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.

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.

Booth 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.

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.

And 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.

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.

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.

Acknowledgements

Fortunately the university covers some of the operating costs of FLAAR on their campus. Thus we do not really have much incentive to pocket hush money from producers of lousy products. 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 is fairly evident rather quickly.

With 12 employees the funding has to come from somewhere, so although the universities cover the core expenses, 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 and for funds to allow us to attend all major international trade shows, which are ideal locations for us to gather information. We thank Drytac, Sun LLC, Bordeaux Digital PrintInk, Mutoh Europe, NUR (now part of HP), IP&I, Dilli, Yuhan-Kimberly, VUTEk and Zund 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. Currently our reports on lamination tips are sponsored by Drytac and our publications on eco-solvent ink printers are sponsored by Mutoh Europe. Now (in 2007), we are seeking corporate sponsorship so we can gradually return to making at least 20% of our publications free to our readers.

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) and the over 350,000+ 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 sites.

ColorSpan, Grapo, IP&I, Mutoh, Dilli, GCC, NUR, Sun, Teckwin, VUTEk, Xerox, Yuhan-Kimberly, Zund have each brought FLAAR staff to their headquarters and printer factories. Bordeaux 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. 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 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 Technologies, 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 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 are universities employees (as is 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 primarily 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 two manufacturers of piezo printers (Epson 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.

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 university 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.