

Introduction to UV-Cured Inks



including Cationic UV Ink



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I have been so occupied visiting UV factories in Europe, the US, Canada, China, and Korea during 2007 and 2008 that I have not had time to check on articles on UV inks in the last several years. But here are some notes from earlier years.	26

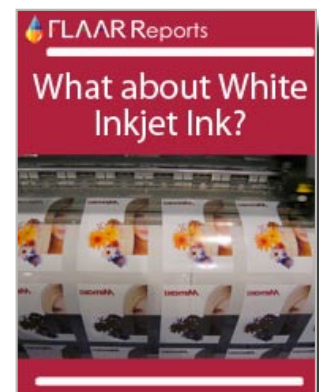
Introduction

In an ideal world, it would be nice to present a comprehensive 50-page discussion of UV-curable inks. But it takes months to track down the information and documentation, not to mention the mental wear-and-tear trying to understand the chemistry involved.

So the present discussion is very clearly at the Fast Facts stage of development. This is intended to be a list of companies that make UV ink, and some comments on things to be aware of. We have a more complete discussion of white UV ink in a separate FLAAR Reports. However the present report on UV ink in general has been updated with deeper discussion of the pros and cons of cationic UV-curable inks. 100 printshops placed orders for a new UV chemistry displayed at SGIA 07 and VISCOM Italy '07, seemingly blissfully unaware of the actual truth about cationic ink. As a result of their not checking about the pros and cons of this ink from any independent source, there are now 100+ printshops who don't have any UV printer and won't for the foreseeable future. Yet their competitors, who do read the facts, were able to select from 45 other viable brands with free-radical ink and avoid a cationic UV ink that was fabulous in pure theory (but a total failure in actual practice).

Six short years ago UV-curable inks for inkjet printing was still in its infancy, as you can see from this quotation from that early era:

“The challenge for ink makers continues to be to develop inks that will meet the application viscosity requirements, adhesion and flexibility, cure speed, pigment stability, and H and S restrictions... Traditional projects, designed for the flexographic or screen print industries, will not satisfy all these technical issues”. (Klang & Balcerski 2002:5).



Bordeaux ink product samples, at factory visit 2007.

Bumps in the Road

What most end-users, and even printer manufacturers, complain about the most often, is that some batches of ink just are not good enough. Or a batch is okay, but clearly not the same as the previous batch. This happened with a mild-solvent ink: the problems with light cyan and light magenta from the chemical plant that makes that ink in Japan. Reportedly it was unusually high humidity one month, and the ink came out affected by the humidity. This ink allegedly caused frequent printhead failure. We know that during the summer of 2005, a user of Seiko inks in Guatemala complained about the light colors of ink. We heard that this problem was recognized elsewhere. Naturally the question arises of whether the defective ink was shipped to Latin America once the problem was recognized?

Frequently we hear that color management is troublesome because the manufacturer changes the ink being received by the print shop owner. So a company that prints 50 of an image in February, and then the client wants another 25 in July, so the printshop cranks out 25 more, but the color does not match the first 50 because either the chemical company or the printer manufacturer has changed the ink (without notifying the end-users).

Recently a major manufacturer of UV-curable ink printers stated that the ink sent him by the billion-dollar ink manufacturer was too often not adequate. Not only that batch to batch it was different, but that some batches had serious issues. This surprised me, especially when I heard the name of the ink company and the description of problems more than once. So the point is, merely being a large ink manufacturer is no guarantee of success. This situation also opens the door to after-market ink companies, since if the original ink source is faulty, then end-users will want a better ink, as will printer manufacturers.

Yet another manufacturer, that uses a slightly different flavor of the same ink, said they are fully content and have no issues whatsoever. But that other manufacturer is using a different printhead.

We were also told that one of several reasons why the first-generation (2004) Zünd 250 printer failed, and was unexpectedly withdrawn from the market recently, was because of ink clogging. They made the mistake of experimenting with cationic ink.

We were also surprised to hear that another major printer manufacturer, that makes their own ink, may have serious ink problems, especially printing on Lexan. Actually it prints beautifully on Lexan, but after a while it begins to come off or otherwise deteriorate.

Another trick is for companies to claim that their printers use their ink. DuPont claimed they made their ink and claimed they made their printers. But the printers were manufactured by the same Chinese company that makes Flora solvent and Flora UV printers. In the end it made no sense why DuPont wanted to take full claim (and responsibility) for printers that were so clearly poorly made. DuPont also claimed the ink was theirs. Yet during 2007 all industry sources suggested that this was not true, and that the ink came from another company. This UV ink was excellent (it was not made in China), but that if it was not their ink, why did they allegedly lie?

Keep in mind that UV-curable ink technology is new. It will take a while for everyone to become accustomed to how to brew an ink that meets everyone's requirements. There are certain laws of chemistry and laws of physics that are tough to go around. Yet despite these bumps in the road, most companies that have invested heavily in UV-curable ink printers are selling their output and bringing in money. So having a UV-curable ink printer, in most situations, is a good idea.

Here is a list of ink companies that make UV-curable ink for inkjet printers. About five of these names came from an presentation in an IMI conference report on UV printers. Check out www.imiconf.com and www.imiEurope.com for further information on IMI conferences that cover UV printers. Some of the conferences and seminars include more detailed information on UV-curable ink.

3M

Every few years 3M tries hard to get into the wide-format inkjet ink market, or tries to sell actual inkjet printers. 3M attempted to sell solvent printers made by Teckwin; this failed because these Chinese-made printers were not reliable during the period that 3M experimented with them. Then 3M attempted to use their ink with L&P Virtu UV printers; one end-user who owned this printer said the 3M ink was bad. Plus 3M is not a company that is really organized to sell wide-format inkjet printers.

Next 3M is trying to sell a Durst Rho 160 printer redesigned by Durst to handle 3M inks. This Rho 160R is only for roll-to-roll materials: not for rigid substrates at all. The samples that I saw at the Durst factory in Brixen, Italy, were of special materials for making traffic signs. I have also been told that the other primary use of the Rho 160R is for making vehicle wrap: most other UV inks can't be applied over rivets on vehicles without the ink cracking. MacDermid ColorSpan also offered 3M ink as an option for comparable usage for vehicle wrap.

During 2007 and now in 2008 3M is getting more and more into UV-cured ink for wide-format printers, such as supplying the ink for curing with LED lamps for the Mimaki hybrid UV printer. But at Shanghai 2008 trade show in early July, this ink was not fully cured; it was tacky to the touch and scraped off with your fingernail. But by FESPA Mexico in August 2008, the ink was re-formulated and was better. But at VISCOM Germany the ink was not fully cured, especially the black ink. At VISCOM Italy a few weeks later, the ink was still tacky to the touch.



3M booth at SGIA 07

3M ink is also the ink used to thermo-form samples at Mimaki booth in past years. But this ink either is not really made for that, or is otherwise nowhere near as thermo-formable as the ink used by Gandy and others.

ColorSpan advertised that 3M flexible ink was available on their model 5440uv hybrid printers (before HP bought ColorSpan). But I was told in 2008 that hardly anyone has tried 3M ink in a ColorSpan printer and that one of the few who did said that the lamps could not cure it adequately.

Aellora Digital¹

¹Primarily for their own SureFire label printer. Their ink was handled by Saati at SGIA 07, but this division was disbanded a few months later.

¹ Aellora went out of business about December 2006 partially as a result of its parent company being sold to another kind of company.

Agfa

The reason Agfa is trying so hard to sell UV-curing printers is because Agfa needs to sell its ink (after spending millions of dollars developing its own UV ink). Reportedly their ink had initial problems with “gas” (usually air). Agfa also had more serious issues with their eco or mild-solvent ink; it caused so many printhead failures on Epson heads that the tech support costs knocked Agfa out of the entire solvent ink market forever. This surprises me since Agfa is trying to be an ink company. Reportedly they have over 100 ink chemists in Europe alone.

Akzo Nobel

Avecia

Bordeaux

Primarily after-market UV ink. I have spent a week in Israel visiting their ink manufacturing facilities, world headquarters, R&D facilities and personnel, etc. Their market expertise is water-based and solvent, though they are interested in UV for obvious reasons. The UV ink of Bordeaux, as of 2007, was still being developed to improve adhesion issues.

Chimigraf

I have seen their special UV printer at FESPA Digital (Geneva, May 2008) and saw their exhibit at FESPA Mexico (August 2008), but there were no printers at the Mexican show. I have not visited their ink facilities so need to obtain more experience before I can comment further.

Collins

Their ink had remarkably good color gamut when we saw it in 2005, better than most of the big name chemical companies. But those larger companies have improved their previously poor ink gamut considerably in recent years. At DRUPA 2008 there was no significant presence of UV-curable wide-format printer inks in their portfolio.

Dubuit (see Encres Dubuit)

I rarely see this ink in the US and you don't often hear of it as an OEM ink either. The quality of what they showed in their booth at FESPA Digital 2008 (Geneva) was very poor (weak, no pop to the color).



Agfa booth at Gulf Print Dubai 07.



Ink chemist at Bordeaux R&D facilities. Factory visit, 2007.

DuPont

DuPont is in the identical situation as is Agfa: both have supposedly independently developed their UV-cured ink, but none of their competitors want to use it (as much industry politics as it is whether the ink is good or bad). So DuPont contract manufacturers printers in China that then create a demand for their DuPont UV ink. The difference is that several people in industry have suggested that DuPont merely pretended that they “made” the UV ink and that in reality it was not really fully DuPont UV ink. Everyone says that the supposedly “DuPont” ink was really from Triangle (now part of INX).

Unfortunately the manufacturer they selected in China had a poor track record in being able to produce reliable printers. Their solvent printers are not even as reliable as solvent printers from Infiniti. The UV printers of DuPont had a generally weak reliability, even when supposedly designed and with the manufacturing supposedly overseen by DuPont. So DuPont pulled out of the UV business and I doubt is a realistic source of UV ink any more either. It is ironic that within a year of DuPont pulling out, the Chinese factory that made their printers woke up to the fact that they were losing clients due to poor quality and today they produce printers (at least those exported to the US) that are acceptable when a few parts are retrofitted in the US.



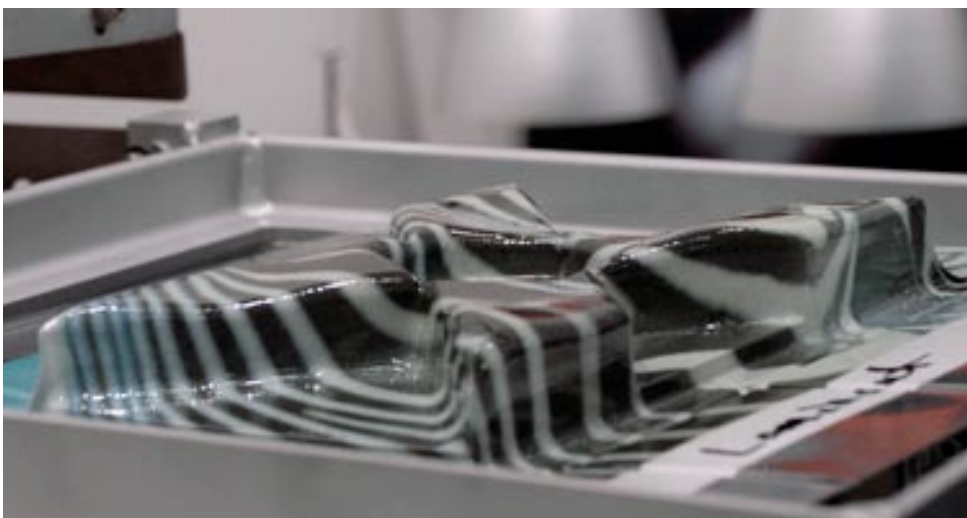
DuPont booth at FESPA 07

Encrex Dubuit

This is a typical example of a company that is strong in screen-printing inks that is trying to enter the world of wide-format digital UV-curable flatbed inks. The stand at FESPA Digital 2008 exhibited exclusively UV ink prints, so clearly they are after this market. But the images were lackluster in terms of pop. This is a polite way of saying they were the duller UV inks at the entire trade show.

Hexion

Hexion exhibited at GraphExpo 2006, GraphExpo 2007, and FESPA '07 trade show. Teckwin is the first company that openly uses Hexion UV ink, in the new Teckwin TeckStorm flatbed that uses Xaar 760 variable droplet printheads.



Thermo-formed samples printed on with Hexion ink exhibited at FESPA 07.



Hexion 3D Plastic booth at FESPA 07.

Hilord

The Hilord web site states they make “UV ink” but provides no other easily accessible information. Otherwise, Hilord makes primarily dye-sublimation inks for printing on transfer paper for heat press sublimation onto polyester based fabrics.

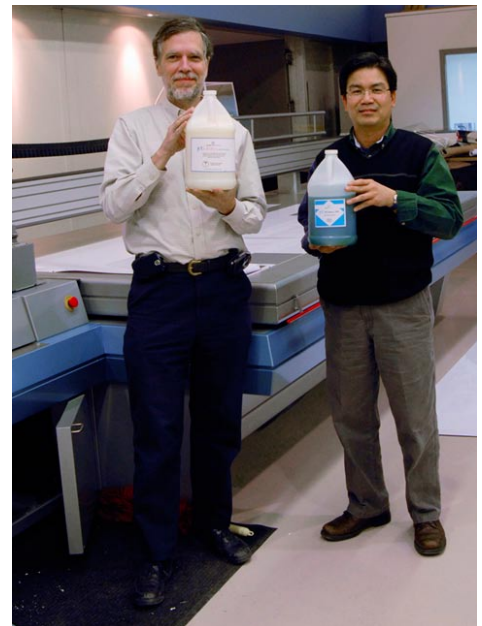
Gandinnovations

Although currently Gandinnovations uses UV ink primarily from Sun, Gandinnovations had its own very capable ink chemists. But that ink department was sold during 2008 to an ink company. This ink companies does R&D for Gandinnovations but they are now open to working with other manufacturers as well.

The thermo-formable ink used by Gandinnovations reportedly comes from a different company than Sun. Gandinnovations is also testing a wide variety of new inks, but as a courtesy to them, we do not list the brands.



5-liter ink containers shot at Gandinnovations factory visit, June 2008.



Gandinnovations has several R&D technicians and its own ink chemists.

Inctec (Daippon, Japan)

Their ink is stated (by a colleague) to print well on Coroplast. Sericol ink (used by Oce Arizona 250) requires a primer before being usable to print on Coroplast.

InkTec

This is a Korean after-market ink company that now makes their own Jetrix UV flatbed printer with roll-to-roll built-in.

InkWare

VUTEk tries to make its own UV ink with their partner company InkWare. But for flexible UV ink, it is worth mentioning that VUTEk uses 3M ink! The ink from InkWare has a reputation for having an odor.

Inkwin

I have visited their ink factory and also their ink testing labs. Their labs have about two million dollars worth of ink testing equipment (better than at any US university I have seen so far). So clearly there are some Chinese ink companies that realize

quality and consistency between batches is crucial for their success and for their OEM clients. The owner of this company has a PhD in UV inks. His wife has a PhD from the University of Kyoto (Japan) in ink chemistry.



Jetrion (Flint Ink sold to EFI/Vutek/InkWare in 2006)

This is probably the ink used in the Océ T220UV. Jetrion is reportedly having serious setbacks in label printing business during 2007-2008.

Konica Minolta (Medical and Graphic)

KonicaMinolta reportedly has an ink partner in Japan. KM sells this as their “own” ink. But since most UV printers that use KonicaMinolta printheads use UV ink from Toyo, it is unclear to what degree there is really a “KonicaMinolta UV ink”; everyone in the industry says it is all from Toyo, but increasingly there is evidence that KonicaMinolta has plenty of capable ink chemists on its own staff. So I am less convinced nowadays that Toyo is necessarily the sole source of all ink for any printer using KonicaMinolta printheads. That said, there are indeed some printers whose ink very clearly is stated to come direct from Toyo.

But there are one or two printer manufacturers using KonicaMinolta printheads that use UV ink from countries other than Japan; GRAPO is one.

KonicaMinolta tries to sell cationic UV ink, but their ink was a total failure for Durst (350R as an alternative roll-fed ink). Now KonicaMinolta is attempting to convince Gerber that it’s ink actually works. In real life, so far this cationic ink continues to have so many problems that it is not very reliable.

Lyson

Lyson, via Nazdar, offers UV-curable inks for a limited range of older UV printers such as Inca Eagle H, Eagle 44, NUR Tempo I and II, and Zund 215C. This is an after-market ink; I am not familiar with any printer manufacturers that offer or list Lyson ink. The Teckwin TeckStorm, however, may use Lyson UV ink.

NUR

Yes, NUR does make some of its own inks. I have twice visited the world headquarters of NUR in Lod, Israel. It has been possible to spend hours with their head ink chemists, visit their ink labs, and spend days inside the R&D facilities of NUR. This level of access is the advantage of being a professor. But now that HP owns NUR, HP has it's own ink resource via Scitex, namely Tech Ink from South Africa.



Nicholas Hellmuth at NUR ink lab, factory visit, 2007.



Outside of the NUR headquarters.



Screen (Dainippon Screen)

This ink is in the Raster Printers Daytona T600UV flatbed. Otherwise, I rarely hear anyone speak of Dainippon ink being in a major brand of wide-format UV printers.

Sensient

A hybrid UV ink from their Swiss facility was shown with an ATP textile printer at VISCOM Italy '08. There will be other larger manufacturers launching textile printers with this ink by mid to late 2009.

Sericol (Owned by FujiFilm)

Inca

Oce Arizona 250 GT

Oce Arizona 350 GT

Zund 215

Zund 250 (but Zund switched to Sun after Sericol's cationic UV ink failed)

Current Sericol ink has the reputation of not being able to print adequately on Sintra because the ink film is too rigid. It flakes off if you cut the printed Sintra. Current Sericol ink (autumn 2008) has issues adhering to Coroplast (fluted plastic used in real estate "for sale" signs and election posters). You need to use a primer, an adhesion promoter. Eventually Sericol will come up with a new version of their ink that overcomes these issues but I am amazed that a company so large, with so much experience, has ink with these weaknesses as currently as autumn 2008.



FujiFilm Sericol booth at SGIA 07.

SunFlower (Sun LLC)

SunFlower is a Russian company, owned by Sun LLC. Their innovative ink works well with LED curing lamps. I have visited the Sun headquarters as well as the SunFlower ink manufacturing, testing, and R&D facilities in Russia (spent a week there). These companies have no relationship whatsoever with Sun Chemical (best known for the UK and Germany).



Dr. Hellmuth at SUN factory in Russia, 2007.

SunJet (Sun Chemical)

- ColorSpan²
- Durst (including thermo-formable ink)
- FastJet (so far has not escaped beta stage)
- Gandinnovations
- Neolt (first generation; current generation switched to Triangle)
- Raster Printers (at least in 2006)

In November 2008 we received reports that Sun ink had issues with not all batches being consistent. And some of the colors were turning out dull. Naturally this depends on the printer, the curing system, and the print modes (as well as the original colors in the image). But the description was not pretty.

So far I know of two companies what have complained about problems with the UV ink from Sun that they received.

T and K Toka, sell through Collins Ink in the US.

At DRUPA 2008 it was clear that Collins was not working much in UV-curable inks for flatbed printers.



Tech INK booth at Fespa Mexico, 2008.

Tech Ink

Tech Ink (Techno Ink Manufacturing) was bought by Scitex Vision International in 2001. This company, in South Africa, supplies HP, HP Scitex, and logically also perhaps NUR too (now that NUR is part of HP Scitex).

Much to my surprise Tech Ink also sells to other UV printer manufacturers other than HP, NUR or Scitex Vision. Indeed Tech Ink is now beginning to exhibit their after-market ink to the public; I saw them for the first time at FESPA Mexico. Probably they had a stand at other earlier trade shows elsewhere but maybe I simply never recognized their brand name because it sounds like a Chinese after-market brand name. I tend not to spend time studying that kind of ink, so never stopped at their booth in the past. But clearly this ink is not made in a bathtub or garage, so I will keep my eyes and ears open during 2009.

Many people ask why HP is willing to sell their own ink to competing companies. Well if you think about this, you can figure out several reasons. Just think.

One printshop owner in Germany, whose printer offers Tech Ink, said that twice the ink was totally unavailable and he could not print with it any longer: once the ink simply was not available from HP. The second time there were problems with the raw pigment material. This can happen with any and all ink manufacturers, large or small. I am sure if you asked every manufacturer they would indicate similar issues with the other brands.

Tech Ink has a reputation for having the strongest smell of any UV ink on the market. I was surprised that what I most heard from other people about Tech Ink is that they say its UV inks have a noticeable and disagreeable smell.

² Now that ColorSpan is owned by HP perhaps they will switch to ink from Scitex's ink plant in South Africa.

Tetenal

This is a substantial company (in other fields) and a known brand, but I don't really see them much in the world of wide-format inkjet printing outside Europe.

Toyo

In some cases a printhead manufacturer will have a silent partnership with an ink company. Reportedly KonicaMinolta printhead company favors Toyo UV ink. Other UV inks can be used in KM printheads, but it's easier to get an entire package of KM heads + Toyo ink. Toyo is a respected company and a respected brand name but what we hear about their UV ink is not encouraging. The main problem is that until we know specifically which brands of UV printers actually use Toyo ink we can't respond to the general opinion in the industry that this ink is not ideal. Sometimes industry assessments don't keep up with actuality.

Almost all UV-curable inkjet printers made in China that use KonicaMinolta heads use Toyo UV ink, such as:

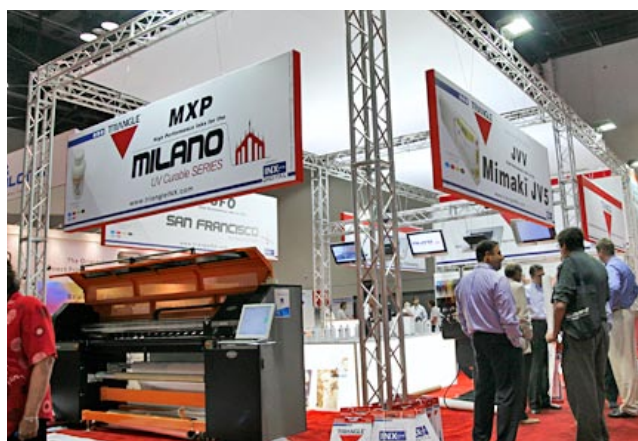
- Docan flatbed
- Sky Air-Ship flatbed



Toyo ink booth at DRUPA 08.



Toyo exhibited an array of materials and applications that can be printed on with its inks at DRUPA 08.



Triangle Digital booth at SGIA 07.

Triangle Digital

Triangle UV ink is used by Infiniti and some other UV printer OEMs. Triangle imports Neolt UV printers for sale in the US and thus it is not a surprise that both use Triangle UV ink. It has been pointed out that Triangle ink's high saturation and attractive gloss is comparable to the output of inks that DuPont claimed were theirs. You can draw your own conclusions. Triangle ink is one of the inks that I see the most potential in. However we do not have it available for testing at our university for documentation.

Xennia

This ink is used mainly in narrow format and/or label printing machines (not in any wide format printer that I am aware of).

Information in FLAAR Reports is based on substantial and continued research

FLAAR continues to study UV-curing flatbed printers during 2008. Until a UV printer is available to us, we do our studies at the factories and demo centers of the manufacturers. So far FLAAR has been invited to study UV-curable printers at

- ColorSpan (several times)
- D.G.I.
- Dilli (several days)
- Durst (a week in early 2008; second visit in September 2008, again in November)
- Flora (RTZ, in Shenzeng), scheduled for late 2008 or early 2009.
- Gandinnovations (twice, two days each time)
- GCC (several days)
- Gerber (an entire day in autumn 2008, including with their ink chemist)
- GRAPO (three times: one in 2006 and twice in 2008)
- HP Scitex
- Inca Digital
- Infiniti (Honghua)
- IP&I (several days)
- ISI (manufactures Raster Printers T600UV flatbed)
- L&P Virtu, manufacturing plant and demo room in Florida
- NUR (twice)
- Oce (intensive inspection of everything on September 2nd, 2008)
- Raster Printers (three times at their demo center in California)
- Spuhl, L&P Virtu partner in Switzerland
- Sun FastJet (next door to Inca Digital)
- Sun LLC (Russia; one week already, second visit scheduled for later in 2008)
- Teckwin (twice, most recently for two days)
- VUTEk (four times)
- Zund (two days)

Plus several Chinese UV printer manufacturers besides Teckwin. So we have a range of experience not available widely elsewhere. Being a professor is definitely an advantage to obtain access to such a diverse range of practice.

Chinese UV ink manufacturers

InkWin is the most sophisticated Chinese ink company that is beginning to work with UV-curable inks. I have visited the factory, headquarters, ink testing labs, and sales offices of InkWin during July 2008.

ShinyColor had a brochure at Shanghai '08 that offered UV ink for Spectra, Xaar, Konica, and Hitachi (Ricoh) printheads. But ShinyColor is not a well known company outside of China and I have not visited their facilities.





Dr. Hellmuth visited the InkWin factory in summer 2008, before the Shanghai sign printer trade show. In the warehouse of raw material it turned out that most of the pigments were from CIBA and Clariant. It is totally different from other China ink factories who primarily use pigments with boxes with Chinese characters.

Why do printer manufacturers use only Sun, Sericol and not others?

Probably 75% of all wide-format inkjet printers use UV inks from either Sericol or Sun. And even if a manufacturer uses other brands of ink, once they find an ink they like, they stick with it seemingly forever: they don't switch to a different brand of ink even if it is better.

For the first six years Sericol ink had a weak color gamut that could not reproduce many logo colors. Yet other than Zund (which dropped Sericol since its cationic UV ink was a disaster), most printer manufacturers never jump from one brand of ink to another. Yes, there are exceptions, but they are the exception that proves the rule.

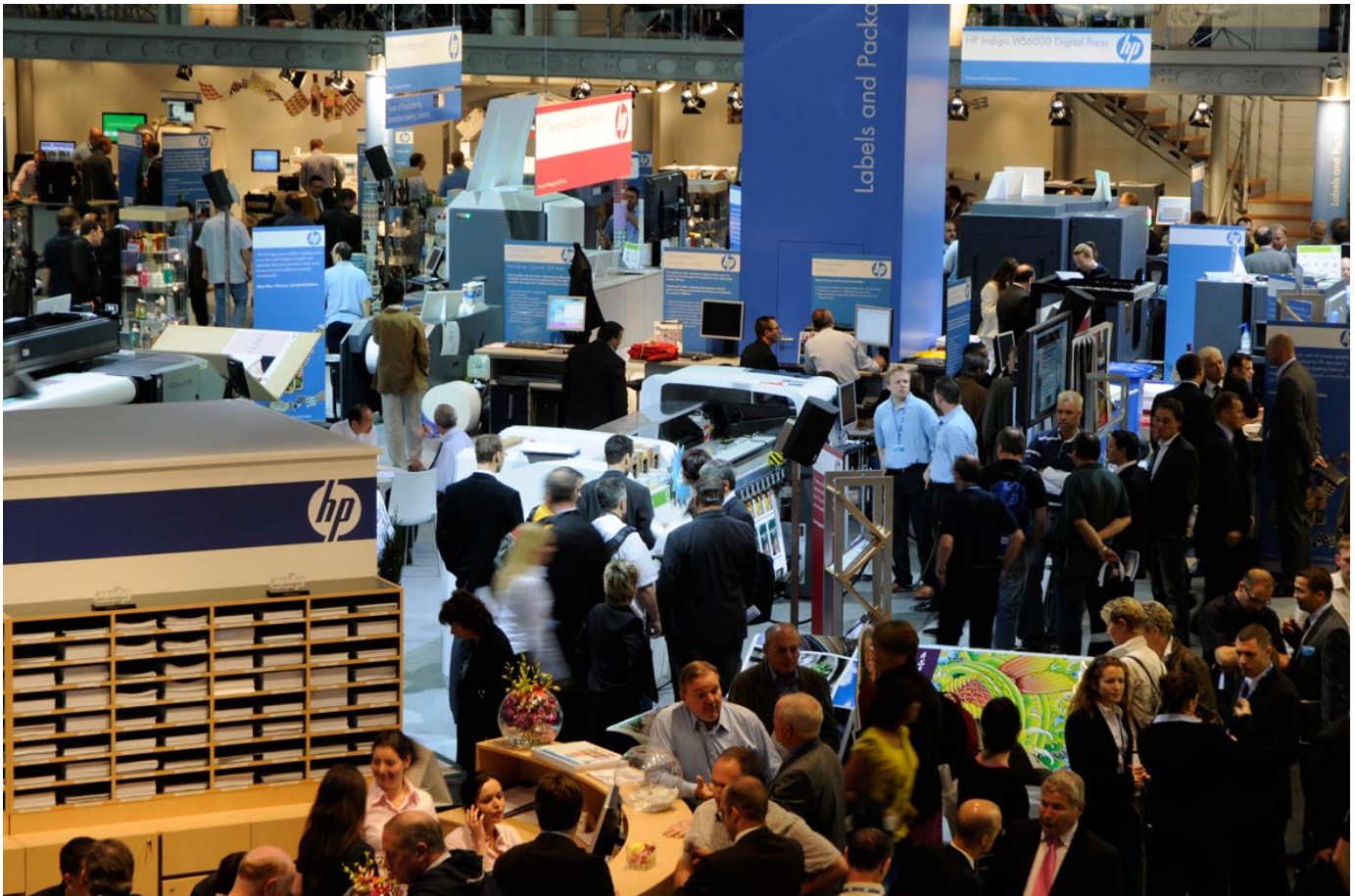
The reason is because a UV-curable inkjet printer is a touchy system where the printheads, inks and other aspects work in unison. You can't simply switch inks; then you also have to change many other aspects of the entire printer system.

So it is very rare that any outside ink company can get their ink used as an OEM supply. It is equally rare that a printshop will switch from the OEM UV ink to an after-market UV ink. So third-party UV ink is nowhere near as successful a business as is third-part solvent ink. Nonetheless companies such as Encres Dubuit keep trying.

Indeed getting your own ink to be selected by a manufacturer is so unlikely that Agfa and DuPont had to try to build their own UV printers in order to create a market for their own UV inks. Agfa's own UV printers failed, unfortunately, and they had to OEM the Dilli printers to create a demand for their Agfa ink. DuPont made the mistake of assuming that DuPont could change Chinese manufacturing culture with infusions of money. Unfortunately the Chinese won and DuPont lost millions. But DuPont has a discrete relationship with another UV ink company, so its situation is a bit more complex (as to who really makes its "own" UV-curable ink).

Misnomer

Unfortunately Hewlett-Packard used the designation of UV ink starting about eight years ago. This is a poor use of the concept of UV several years before UV-curable ink because a moniker for flatbed printers. HP's UV ink is not ultraviolet curable whatsoever; it is just a normal water-based pigmented ink. HP has stopped using this term for their pigmented ink, but it is still stuck in the literature and still continues to mislead people.



HP booth at Drupa 08.

How many different kinds of UV-curable inks exist?

No one UV ink is perfect. No single UV ink can really print on everything acceptably. For example, many UV inks don't print well on CoroPlast. Other inks print well but it falls off after several months.

Ink from InkWare (VUTEk) had well publicized issues for about a year with respect to falling off Lexan. Sintra is another material that's not easy to print on.

So be wary of any claim that "our ink prints on everything" because yes, you can jet ink onto any and every substrate and material: but the ink will abrade, or flake off, or peel off, or simply smear off (such as on glass or Plexiglas).

A large digital print shop has reported several times that the ink currently used by Océ Arizona 250 (Sericol) consistently chips off the edges of some popular rigid materials when you cut or trim those materials.

Also beware of tricks that some companies pull, namely using primers to make the samples in their trade show booths without telling you, or using clearcoats (topcoating) to protect the weak abrasion resistance of their ink on certain materials.

- Ink for FLEXIBLE materials (3M wishes to become a leader here)
- Ink for RIGID materials
- GENERALIZED ink, one-type-works-for-all (sort of)
- Ink for CORRUGATED materials
- Ink that can be thermo-formed

Flexible UV inks are so vinyl can be used to wrap vehicles. When your vehicle wrap goes around rivets, the ink film gets stretched. Normal UV-ink will crack or break at this point. So you need a special chemistry that stretches. Xaar states that SunJet Crystal UFX inks combined with its Xaar XJ500 printheads will work well on flexible substances such as :

- PVC
- Polycarbonate
- polypropylene

Rigid UV inks are for flat rigid material that won't flex much.

A generalized ink is one that works well for flat rigid material, but will flex a little bit, albeit not enough for vehicle wrap over rivets.

Ink for corrugated material is for packing material, for boxes, or for displays made of the same material. The Durst Rhopac is one such printer. The Inca FastJet, using SunJet ink, would be another such printer, but it has not been seen or heard of since a concept-car prototype was shown at DRUPA 2004. There has been no Fast Jet at any Inca or SunJet booth since then, especially not during 2005. But based on information available at the IMI technology conferences in Lisbon, Portugal, November 2005, reportedly development is still proceeding on the FastJet. In the meantime, the most successful printer for corrugated material is the Scitex Vision CORjet. This uses unique Aprion printheads and hence not presently a UV-curable ink.

We will have more information on thermoformable UV inks later in 2007, as a separate FLAAR Reports.

What is in a UV-cured Ink?

There are countless chemical recipes for UV-cured ink. Even from a single supplier, such as Sunjet, the ink they provide Gandin-novations may be slightly different than the ink they provide ColorSpan. But basically a UV-cured ink includes

- Monomers
- Oligomers
- Pigments (for the color)
- Photoinitiators
- Additives (to provide beneficial features and to reduce other bad features)

The pigments require dispersants, especially for white ink. The photoinitiators are a veritable soup of chemicals. 95% of the UV-curable inks today use free radical chemistry. But the new Durst Rho 350R uses cationic chemistry.

If you wish to learn the basics of UV-curing ink (and the difference between cationic and free radical photoinitiation), we recommend you attend any of the IMI conferences or training programs on UV-cured ink. You can contact IMI in the US via www.imiconf.com, or www.imiEurope.com if you are in that part of the world.

For example, a paper by Dr Alan Hudd provides endless chemical formulas on everything from pigment dispersions to everything else you might need to know.

If you wish to learn about monomers, read the papers published by Sartomer. Sartomer makes monomers used in inkjet inks.

Carcinogenic chemicals and chemicals that cause possible issues with your genes

Roland is calling their inks “eco” so let’s hope their MSDS does not include some of the chemicals that are in several other UV inks that are carcinogenic and other chemicals that may cause genetic disorders. Mimaki is also claiming their UV inks are eco. This is not a good idea since it only draws attention to the fact that two or three other brands still have these chemicals in them.

Check to see if the ink in the printer is R40 or R43 (Risk Class). Be aware that in some parts of the world, any ink with these chemicals are not allowed for indoor applications.

% of Pigments in UV Ink

We are in the process of learning more about the percent of pigments in the different UV inks. Some UV inks are highly pigmented; others have half the amount.

I thank the knowledgeable people in the UV printer industry who have assisted me in learning about these aspects of UV inks.

Hybrid UV inks from Aellora

Aellora always had a nice booth at trade shows during 2004, 2005, and 2006. Their entire product line was totally different than most others.

Aellora had an ink to print on glass bottles. They specialized in white ink to print on black materials.

Aellora tried to sell their print engines and their inks. But all the competing companies were building giant sign printers. Aellora was mainly into narrow-format label printing.



Nicholas Hellmuth at Aellora booth, Graph Expo 06.

Then Aellora developed a 1-meter flatbed printer. But Mimaki already had the market for that. And Aellora did not really have any dealers around the country, much less around the world.

Unfortunately Aellora folded in late 2006. But if you are into ink chemistry, try to find old news releases about their hybrid UV inks. And try to find former Aellora managers in their various new jobs at trade shows. They were all capable individuals. Indeed two Aellora managers reappeared at SGIA: one at Summit; another at Saati. Saati took over the hybrid ink project, and even introduced a full-scale printer to handle it: the Jupiter (made by Dilli, a respected manufacturer in Korea). Unfortunately Saati, a screen printing company, decided to pull out of digital printing precisely after introducing the Jupiter at SGIA. What a waste of time and effort to have started a project and then canned it so quickly.

UV Ink for curing with LED Lamps

Many printer manufacturers have experimented with LED lamps for UV curing. So far Inca was the most successful, with their Spyder 150. Otherwise, other experiments elsewhere tend to use UV-LED light just for pinning, only 400 nm. But you can't find ink for this wavelength (comment by a helpful colleague with experience in this branch).

Sun LLC is successful with their NEO LED Evolution printer because Sunflower ink can make an ink that reacts at the best wave-length for the LED lamp wave-length, namely 365 (if my memory serves me). There are separate reports on UV lamps in general and on Sun LLC UV lamps in particular.



Nicholas visited SUN factory to study the UV printer that has proven successful to cure with LED lamps.

The ink for the new Mimaki UV printer using LED curing comes from 3M.

There is now a separate FLAAR Report on the LED-curing printer from Roland.



Mimaki UJV-160 at Drupa 08.



Roland LED-UV LEC-300 at Photokina 08.

Cationic vs Free Radical Chemistry

Up to 2004 all photo initiator chemistry was based on free radicals. Then Durst offered the first cationic chemistry for the world of wide-format. This ink comes from Japan. Unfortunately the experience of Durst with the Japanese cationic ink for the Rho 351R was a disaster. Durst declined to discuss how bad the cationic was (it was not their fault, the ink came from Japan). But we were told second-hand that the ink stuck well but fell off many or most materials after about two months.

Sericol cationic ink was tried in the Zund 250. The resulting dissatisfaction of end-users resulted in this printer being withdrawn from the market for almost two years. This caused a loss of about a million dollars a month in lost printer sales for Zund. They stopped recommending Sericol ink and switched to Sun.

Sericol had, reportedly, already offered their cationic ink to Inca, and it had not worked on Inca printers. But Zund did not know this until it was too late.

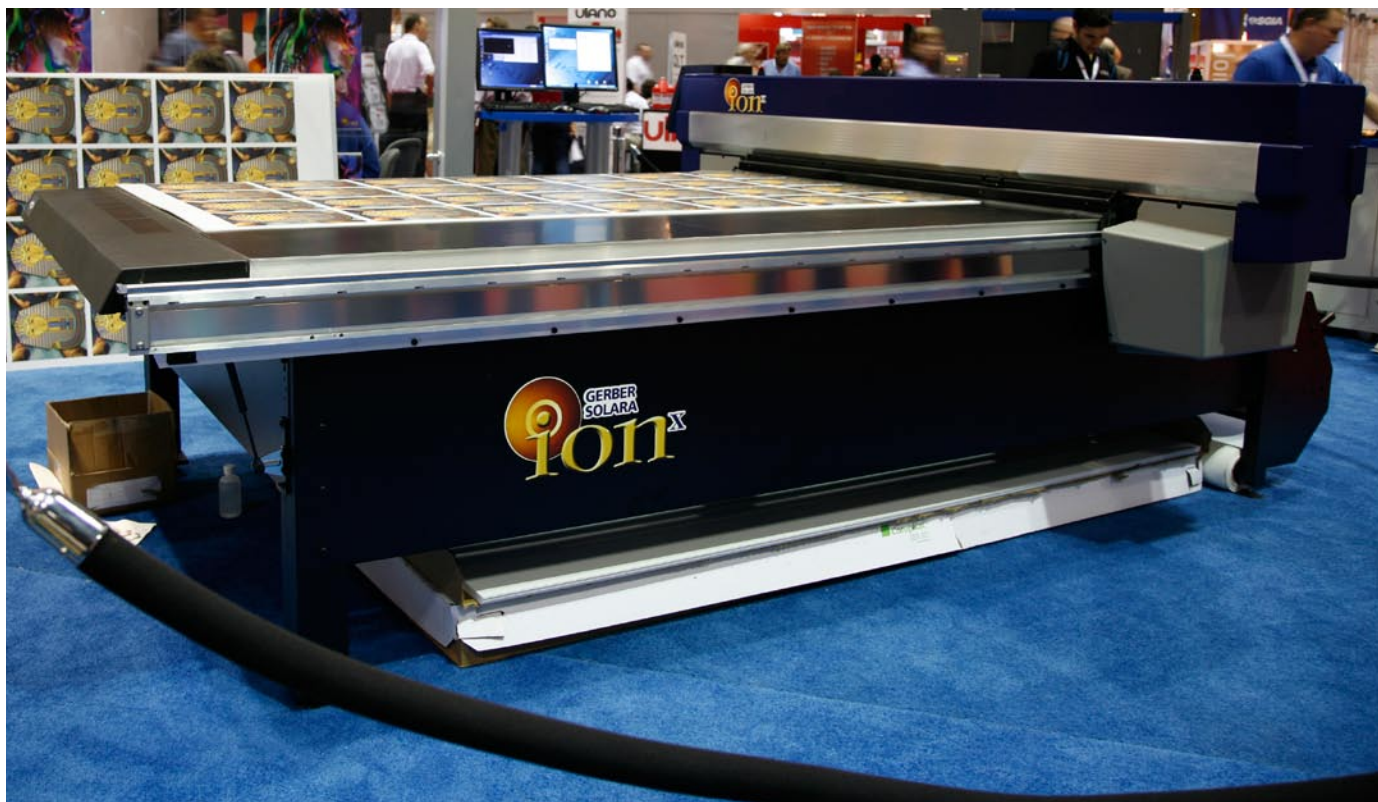
Now Collins Ink offers a cationic chemistry option too; also from Japan but from a company different than the ink source for Durst. As an aside, LEDs also come from a Japanese manufacturer, though the arrays are assembled in England, Europe, or the US.

Reportedly Sun Chemical is working on cationic UV ink as well. They are starting with a black cationic ink.

Recently (since summer 2007) one major large-format UV-curable printer manufacturer is discretely testing UV-curable ink. Reportedly this ink works acceptably.

Gerber is the first company to publicly try cationic ink (launched at SGIA, October 2007). Since the printer is an unfinished prototype it's difficult to judge what is causing the curious appearance of the printed results: the newness of the hardware and software, or peculiarities in the "fluorescent" UV lamps with the ink. You can call the ink either innovative or unproven (or both). I admire Gerber's innovation but having seen so many new technologies crash (HP's MEMS printheads are two years delayed already).

Gerber wisely declined to allow any samples to be taken, and they were printing only on a strictly limited number of kinds of materials. They are very brave to show to the public a prototype that clearly has a long period of gradual maturity ahead of it.



Gerber ion* prototype at SGIA 07.

But 95% of UV-curable inks still use free radicals. However with companies such as KonicaMinolta, Sericol and Sun experimenting with cationic chemistry, you can expect more of this class of photo initiator during 2006 and 2007. As might be expected with any new chemistry, the first cationic inks don't yet "work," indeed an early use of a premature cationic ink was one cause of the withdrawal of the Zund 250 inkjet printer last year. Durst is the other company brave enough to publicly offer a cationic ink option, for their roll-to-roll Rho 350R. However this ink is "not quite ready," so buyers of this printer can use free radical UV-cured chemistry in the meantime.

What are the chemical formulas? Go to any IMI conference and you will get enough chemistry instruction to make you feel like you are back in a UV-Inkjet 101 course. The best articles on cationic vs free radical UV ink chemistry are by Joe Clarke, in two articles during the spring and summer in *Digital Graphics* magazine.

The specific problems with cationic UV-curable ink

A few weeks before SGIA 07, Gerber initiated the most sophisticated printer-launch campaign that I have ever seen. The graphics and the overall concept of the launch PR was impressive: significantly better than of any other printer.

So I, and everyone else, had high expectations to see an equally impressive cationic ink, cool curing system, and dual dedicated flatbed combined with dedicated roll-fed.

But what was exhibited was a roll-fed that did not move (it was simply not functioning). The flatbed functioned only a few hours each day. Indeed most people at SGIA asked me "Nicholas, did you see the Gerber ion actually move? Yes, it did move occasionally, and the output was most politely described as unique. Unique in the sense that the manner in which the ink cured was bizarre. At VISCOM Italy a few weeks later the output did not look so splotchy and the machine actually functioned a bit more often. Reportedly over 100 orders were taken at the two trade shows.

But during the next eight to ten months, the performance of the printer varied from poor to embarrassing, and the printer was withdrawn from FESPA Digital '08 in Geneva (it was prominently announced as being present but when the show actually opened it was not shown at all). At DRUPA the performance was lethargic the first two days and poor to non-performing the rest of the two weeks.

Since I had such high hopes for the new inks, I was disappointed between SGIA '07 and DRUPA '08. So I tried to understand what was causing the ink portions of the problems (issues with circuit boards and reliability of internal components was an entire different set of problems that had to do with quality control of suppliers and the manufacturing process; I was more interested in the cationic UV ink).

So I began to make a list of pros and cons of cationic ink. Since Gerber already lists all the pros, and since an avalanche of PR releases repeats all these claims, let's look at what no one says in the PR releases, but what ink chemists and industry analysts talk about at technical meetings:

A few downsides of cationic UV ink are:

- Has issues if the relative humidity is below 20% or over 50%
- But what if cationic inks are conductive?
- What if cationic ink gels on contact with aluminum? After all, many of the parts inside a UV printer are made of aluminum.
- What if the ink creates a battery when in contact with certain metals. What if these are precisely the metals out of which a printer is manufactured (chrome, steel and aluminum alloys)?
- What if cationic ink causes galvanic corrosion?
- What if corrosion generates metal ions?
- What if only three cationic ink photoinitiators are available?

- What if cationic ink photoinitiation creates super acids that cause yellow to turn muddy brown and cause bright reds to turn muddy brown?
- What if the ink spontaneously gels inside the printer under certain conditions?
- What if the ink begins to gel if the temperature in the room gets over 40 degrees C? Many countries around the world have summer temperatures that are easily hotter than this.
- What if the cationic curing process creates benzene?

Combine the above issues with jettability and general reliability issues, and you can begin to understand why cationic ink failed.

- Inca was provided cationic ink from Sericol; it failed.
- Then Sericol suggested to Zund that they try this ink (Zund did not know it had already recently failed with Inca).
- KonicaMinolta offered a cationic ink to Durst. It failed totally.
- Now Konica Minolta is encouraging Gerber to use their ink. It still does not work.

Now, on your own, you can gradually see how all these problems arise. Not only does heat start the cationic ink curing reaction, but light, and molecules too. Nonetheless, the Gerber ion functions in a lab environment and functions, albeit slowly, in a beta test environment. But it is not without "issues." The question is whether the slowness and the other issues are acceptable for printshops.



Nicholas Hellmuth at Gerber factory, September 2008.

One thing I was told by an experienced resource who knows cationic ink, was that "as you made the cationic ink cause fewer problems ionizing metals in the printheads and ink tube system, the cationic ink loses many of its otherwise beneficial qualities." In other words, they could tame the ink, but once tamed, it was not as impressive any more.

The first generation UV printers all eventually failed: the Sias UV printer from the late 1990's being the first. It took about two years for the Zund 215 to be usable. The first jet airplanes, the Comet, crashed with embarrassing frequency. But today we all fly on jets without much worry. The same thing will happen to cationic UV ink (unless some other chemistry and technology replaces it; but latex ink can't print on thick rigid materials; only on roll-fed substrates).

If you are about to consider a cationic ink printer you might also want to check how long screen printers used cationic ink before this ink disappeared from being experimented with.

It is also worth pointing out that you don't see any articles in public on any of this. Only two articles have appeared so far, one I wrote in SIP and a separate article by Dr Ray Work for Digital Graphics Magazine, based in part (with my permission) on my comments on www.large-format-printers.org.

A new problem has just been recognized with cationic ink. I have not seen this reported in any article, mentioned by any ink chemist, and definitely not listed in any Success Story. This is the "fading" and weak saturation of cationic ink on porous substrates, such as either paper or some wall materials. It is as though the ink is soaking in and is not being fully cured by the germicidal-type UV lamp being used by Gerber.

In addition to Sericol and the partners of KonicaMinolta, Sun and other companies are also experimenting with cationic ink, but none have tamed it yet.

The other question is how many beneficial features will remain of a cationic ink that has been so changed to make it "function." It would be helpful if more chemists published articles on the pros and cons of cationic UV ink.

In September 2008 it was possible to spend an entire day at the Gerber world headquarters, the factory for the ion, and on the day before all this, to spend three hours speaking with their top ink chemist and head of Gerber research. Naturally most of the topics and details are under NDA, but they feel they have cationic ink functioning. The question remains: will it function the same way outside the lab; why is it so non-functional at all trade shows; and how long will the printheads hold up.

For these reasons, in the separate FLAAR Report on the ion printer system, I list about seven or so tests that this printer ought to pass before it can be removed from the "problematical beta test stage" to the stage of a properly functional wide-format inkjet printer that actually works in the real world.

Yet despite all the reasons why cationic ink does not function appropriately, I did test printing hour after hour in the Gerber demo room at their world headquarters. I also saw the hundredth Solara ion printer being prepared for shipment, and it is hardly likely that any substantial company would ship 100 machines that were non-functional.

Color Gamut issues with UV-cured inks

Two ink companies were not able to produce the reds of their original logos. Most UV ink has poor reds (reds are all orange).

Most UV yellow is either dirty (ColorSpan) or too green.

Most UV green is too yellow.

So if you have logos in certain colors, these colors may be hard to reach with UV-cured inks. The colors get better, but most reds, greens, and yellows are poor, even today in 2008.

Longevity with UV-cured inks

There is not much pressure from anyone to require that UV-cured inks last longer. UV-cured inks last longer and hold up better than dye-based water-based inks. But I would not rate longevity as a strong point for most UV inks. They will hold up okay outside in the sun a few years, but some UV inks are not that good in the sun, or even inside after a few years.

What will 2008-2009 Bring?

Cationic ink chemistry will continue to mature. LED light clusters will continue to get better. Other even more innovative forms of UV-curing lamps will be introduced (Gerber's "fluorescent-like" lamps are the first wave). Ink chemistry and curing in general will be better.

Sericol was the source for the cationic ink that did not work for Inca and was catastrophic for Zund and it's first generation Zund 250 printer. KonicaMinolta's ink partner was the source for the cationic ink that caused total failure of the optional cationic ink for the Durst Rho 350R.

Dr Ray Work is knowledgeable on cationic UV ink, and it's significant issues. He indicates that in addition to the Japanese source for KonicaMinolta cationic ink for Gerber, that Sun, Sericol, and Triangle are working on this chemistry.

And we may hear more about using thermal printheads for UV-curable water-based inks. How about a Canon Bubblejet UV-curable printer for your office?

Don't snicker; Canon has already experimented with UV-curable inks.

But at present, the only really new UV inks are better flexible ones (for car wrap, for example) and thermo-formable inks (another different kind of flexible ink, not the same formula as the ink needed for vehicle wraps).



Canon booth at SGIA 07.

What will 2008-2009 Bring: Water-based UV-curable inks?

Water-based UV-curable inks are already being discussed. In other words, major breakthroughs are happening at an increasing rate. Patents are already applied for, such as United States Patent 6846851. KonicaMinolta lists a water-based UV ink as far back as 2005 (their lecture for IMI, Lisbon).

The first water-based UV ink that I have noticed in a wide-format printer is Sensient ink in a textile printer from ATPColor.

Sample UV Ink Costs

These figures are almost never mentioned in any spec sheet. When the manufacturer lists the costs for water-based inks for traditional inkjet printers or toner for laser printers, the figures vary from wishful thinking to outright misleading. Fortunately some companies are honest (because they have nothing devious to hide). And in rare instances we can obtain figures from end-users, though few end-users make these calculations. Since buying and running the average UV printer costs more than the university provides our facilities in a budget year, it is not realistic to work out these figures ourselves.

Prices vary by region and chance by year. If you notice a discrepancy, please notify us at ReaderService@FLAAR.org. Most of this prices are the current prices as of SGIA 08. Some of these are prices in 2005, of these, some prices rose for 2007, other prices have dropped, but considering that the ink gets substantially better every two years even a price rise is covered with improved adhesion and a better color gamut.

	Ink cost per liter	Ink Cost per sq mt.	Ink Cost
AGFA Anapurna X and XL, XL2	123 Euros \$150	\$1.40	Per sq Ft.
AGFA :Anapurna M	\$160	\$1.20	14¢
Dilli Neo Titan	\$150		12¢
Dilli Neo Plus	\$150		
Dilli Neo Venus	\$145		
Durst Rho 351R	\$99 regular \$189 cationic (2005)		
Durst Rho 600	\$178 per liter		
Flora LJII 1800	\$150		
Gandinovations JETI 3150 flatbed UV printer	\$150 per liter		
Gandi flatbed 1224	\$125	\$1.60 - \$1.80	
Gandi flatbed 2030	\$125	\$1.60 - \$1.80	16¢ - 18¢
Gandi JETi 3348 UV roll-to-roll	\$60	90¢	16¢ - 18¢
GCC StellarJet 183UVK	\$165	\$1.10	9¢
GCC StellarJet UV 250	\$575 for the 5 kilos (\$165 per liter)	\$2.00	11¢

Gerber Solara Ion Flatbed UV	\$245	\$1.90	20¢
HP Scitex XP5100 and HP Scitex XP5300	\$100	40¢	19¢
HP Scitex XP2100 and HP Scitex XP2700	\$80	80¢	
HP-Scitex FB910 UV combo printer	\$595 per 3 liters or \$198.33 per 1 liter	\$2.50	8¢
HP Designjet H35000 and HP Designjet H45000	\$225 per liter.		25¢
HP Scitex Vision FB6100	\$80 - \$100	50¢ - \$1	
Inca Spyder 320	\$187 per liter of ink	\$1.50	5¢ - 10¢
Inca Spyder V	\$187	\$1.50	15¢
Matan Barak5, Barak3	\$85	40¢	15¢
Mimaki JF-1631,JF-1610	€150 & €200 a liter, \$100	\$2.50 (CMYK)	4¢ - 8¢
Oce Arizona 250 GT	\$250	\$4.80 (CMYKW)	25¢ (CMYK) \$48 (CMYKW)
Oce Arizona 350 GT	\$250	\$1.7	17¢
RasterPrinteress H700UV	\$180	\$1.7	17¢
Teckwin TeckStorm	\$175	\$2.20	22¢
Teckwin TeckSmart UV1600 Teck UV S2500	\$160	\$1.50	15¢
Vutek QS2000, 3000	\$180	\$2.00	20¢
Vutek DS series	Not yet on sale at SGIA 08. Information will be available next year.		

Note: The information provided in this chart was gathered at SGIA 08. We will be completing the data of the printers listed here, and adding information on more models.

As you can see, one ink stands out as very costly (Gerber). Even when ink-per-liter price is a tad higher than average, if the software can control ink usage (such as with ColorSpan), your actual ink costs are no more than "lower priced" ink in a system that wastes ink.

Another ink whose cost end-users complain about during 2008 is the expensive UV ink of Mimaki. Plus (another issue), Mimaki is stuck using old-fashioned Epson-style cartridges (even through they don't use Epson printheads).

A major factor in ink cost is more than just the cost-per-liter; what if your printheads require constant flushing, purging, spitting, or comparable ink wastage. Again, end-users write to complain about how much the Toshiba Tec heads in Mimaki UV flatbeds waste ink during constant purging. I have unconfirmed reports that Seiko printheads may need more purging or spitting (hence more wastage of costly ink) that most other printheads, but I have not yet confirmed this observation.

The general trend is the larger and more expensive your printer is, the less it's ink costs per liter. The smaller and cheaper your UV printer is, the more its ink is likely to cost per liter.

Ink costs also vary by how much you order per year: the more you consume the lower the cost is per liter. Some printer (and ink) manufacturers lower their prices for large and regular consumers.

How much ink does an average UV printer use in a year?

One colleague in the industry said, for example, that one brand of printer (mid-range) used an average of 118 liters per printer per year (I need to check if this is per-color or total).

We will try to learn more about this rate of consumption in the future. Most companies either do not know the answer, or prefer not to make this information available.

Quick Conclusions: Aftermarket UV ink

At present, the only aftermarket UV inks that we are considering are the ink of Triangle, Hexion and Sun LLC. As soon as it is possible to find end-users using Marabu inks, this is the next company that we would considering adding to our lists. I have visited a printshop using Inkware solvent inks; the owner said they were better than solvent inks from Lyson (Nazdar). As soon as I can land in the same city as a user of UV inks from Inkwin, this is the next company whose after-market UV inks that FLAAR will evaluate.

One after-market ink company owner said quite openly, "Nicholas, my UV ink simply does not adhere to several key materials."

Now you see why we approve of some inks but don't list or feature others.

Bibliography¹

I have been so occupied visiting UV factories in Europe, the US, Canada, China, and Korea during 2007 and 2008 that I have not had time to check on articles on UV inks in the last several years. But here are some notes from earlier years.

CAMPBELL, Nick

2005 LEDs for UV Curing -- Past, Present & Future. 13th Annual European Ink Jet Printing Conference, November 2005, Lisbon, www.imi-Europe.com.

CLARKE, Joe

2006 UV-Curing Inks: Free Radical vs. Cationic. Digital Graphics Magazine. June 2006, Vol. 10, No. 6, pp. 22-28.

He wrote two articles, this and another one in the same journal a month or so later. One was primarily on free-radical UV ink; the other was primarily on cationic UV ink. Both are well worth reading.

CLARKE, Joe

2006b Deep inside Cationic: Improvements in UV Curing Inks, Part II. Digital Graphics Magazine, July 2006, pp. 40-42.

HUDD, Alan L.

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

HUTCHINSON, Ian

2005 UV Chemistry. UV Ink Jet Printing Course. Nov 2005, Lisbon, IMI-Europe.

¹ There is a separate FLAAR Reports that is a more comprehensive bibliography. All FLAAR Reports can be obtained from www.wide-format-printers.net.

This presentation contains everything you could possibly wish to know about the chemistry of UV inks: everything about monomers, oligomers, photo initiators, and everything else, including a detailed list of health hazards (primarily to the skin).

KLANG, Jeffrey, and James BALCERSKI

2002 New Developments in the Commercialization of UV Curable Inkjet Inks. Sartomer Company.

LARSON, Richard

2004 UV Curable InkJet Chemistry Platforms: Cationic vs Radical. IMI, 2nd UV Ink Jet Symposium, Scottsdale, Arizona, Feb. 2-3, 2004.

MARX, Dan

2005 Critical Questions for Flatbed Purchases. SGIA Journal, Fourth Quarter 2005, pp. 13ff.

NAGVEKAR, Devdatt S.

2008 UV-Curable Graphic Arts versus Industrial Inkjet Inks: A Progress Report. RADTech Report, July/August.

OHNO, Akiyoshi

2005 Inkjet Textile Printing: History. IMI conference PowerPoint, Lisbon, Nov. 2005.

SAPIR, Lilach

2005 UV Ink in the Wide-Format Market: Should Wide-Format Printers take the Cure? SGIA Journal, Fourth Quarter 2005, pp. 23ff.

This article is the point of view of Scitex Vision, now part of HP Scitex.

WALSHE, Paul

2005 The Challenges of Ink Jet Ink Formulation for Packaging. IMI 13th Annual European Ink Jet Printing Conference. Lisbon, November 2005.

The complete bibliography for UV-cured inkjet printers is a separate FLAAR publication. Especially see IMI conference reports, and check the bibliography to the FLAAR Reports on white UV-ink.

WORK, Ray

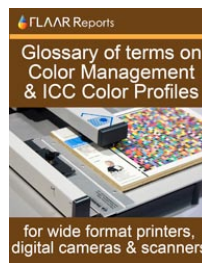
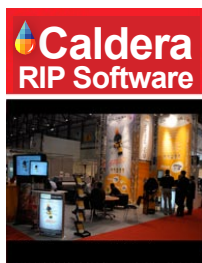
He has written several informative articles during 2007 and 2008, in Digital Graphics magazine.

The complete bibliography for UV-cured inkjet printers is a separate FLAAR publication. Especially see IMI conference reports, and check the bibliography to the FLAAR Reports on white UV-ink

Most recently updated twice in December 2008.

First issued October 2005. Updated June 2006; During this update we added the first chart of ink costs. Updated March 2007, October 2007, November 2007, January 2008, April 2008, June 2008, July 2008, August 2008, September 2008, October 2008.

Updated three times in November 2008.



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

RIP, COLOR MANAGEMENT, and ICC Color Profiles options

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

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

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

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

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

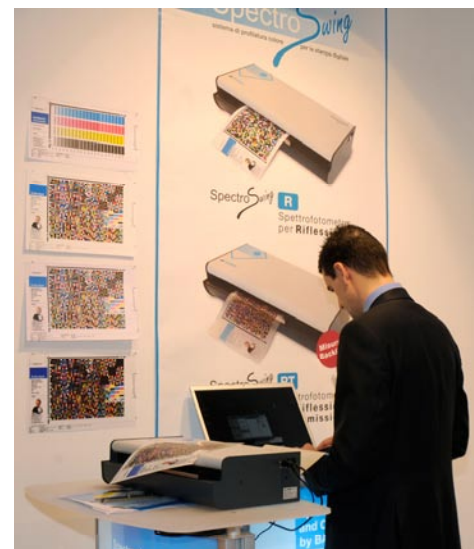
Most recently I have seen Caldera RIP at the Shanghai printer trade show in China, at DRUPA in Germany, at FESPA Digital in Geneva, SGIA '08 and Viscom Italy '08.

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

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



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



For further information on Caldera

contact Joseph MERGUI
mergui@caldera.fr

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

www.ImageTechDigital.com

Mark Spandorf (owner and president),
mark@imagetechdigital.com

or 510 238-8905. If you are in Europe or the rest of the world you can contact BARBIERI

directly at: BARBIERI electronic snc,

info@BARBIERIElectronic.com

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Tel.: +39 0472 834 024

Fax: +39 0472 833 845

Reality Check

Being a university professor for many years does not mean we know everything. But intellectual curiosity often leads us to enter areas that are new to us. So we do not shirk from entering areas where we are obviously not yet expert. 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, because since we are not dependent on sales commissions we can openly list the glitches and defects of those printers that have an occasional problem.

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

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

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

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

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

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

Please Note

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

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

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

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

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

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

Citing and Crediting

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

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

The material in this report is not only copyright, it is also based on years of research. Therefore if you cite or quote a pertinent section, please provide a proper credit, which would be minimally "Nicholas Hellmuth, year, www.FLAAR.org. If the quote is more than a few words then academic tradition would expect that a footnote or entry in your bibliography would reference the complete title. Publisher would be www.FLAAR.org.

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

Legal notice

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

Advisory

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

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

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

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

Equally often, what at first might be blamed on a bad product, often turns out to be a need of more operator experience and training. More often than not, after learning more about the product it becomes possible to produce what it was intended to produce. For this reason it is crucial for the FLAAR team and their university colleagues to interact with the manufacturer's training center and technicians, so we know more about a hardware or software. Our evaluations go through a process of acquiring documentation from a wide range of resources and these naturally include the manufacturer itself. Obviously we take their viewpoints with a grain of salt but often we learn tips that are worthy of being passed along.

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

Another reason why it is essential for you to ask other printshop owners and printer operators about how Brand X and Y function in the real world is that issues may exist but it may take months for these issues to be well enough known for us to know the details. Although often we know of the issues early, and work to get this information into the PDFs, access to information varies depending on brand and model. Plus with over 300 publications, the waiting time to update a specific report may be several months. Plus, once a printer is considered obsolete, it is not realistic to update it due to the costs involved. For these reasons, every FLAAR Report tries to have its publication date on the front outside cover (if we updated everything instantly the cost would be at commercial rates and it would not be possible to cover these expenses). At the end of most FLAAR Reports there is additionally a list of how many times that report has been updated. A report with lots of updates means that we are updating that subject based on availability of new information. If there is no update that is a pretty good indication that report has not been updated! With 101 models of UV printers, several hundred solvent printers, and scores of water-based printers, we tend to give priority to getting new reports out on printers about which not much info at all is available elsewhere. So we are pretty good about reporting on advances in LED curing. But glitches in a common water-based printer will take longer to work its way through our system into an update, especially if the glitch occurs only in certain circumstances, for example, on one type of media. With several hundred media types, we may not yet have utilized the problem media. While on the subject of doing your own research, be sure to ask both the printer operator and printshop owner or manager: you will generally get two slightly different stories.

A printer operator may be aware of more glitches of the printer than the owner.

But even when we like a product and recommend it, we still can't guarantee or certify any make or model nor its profitability in use because we don't know the conditions under which a printer system might be utilized in someone else's facility. For ink and media, especially after-market third-party ink and media, it is essential that you test it first, under your conditions. We have no way to assure that any ink or media will be acceptable for your specific needs in your specific print shop. As a result, products are described "as is" and without warranties as to performance or merchantability, or of fitness for a particular purpose. Any such statements in our reports or on our web sites or in discussions do not constitute warranties and shall not be relied on by the buyer in deciding whether to purchase and/or use products we discuss because of the diversity of conditions, materials and/or equipment under which these products may be used. Thus please recognize that no warranty of fitness or profitability for a particular purpose is offered.

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

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

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

Results you see at trade shows may not be realistic

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

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.

Factors influencing output

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Realize that a FLAAR Report on a printer is not by itself a recommendation of that printer.

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.

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

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

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

Acknowledgements

With 15 employees the funding has to come from somewhere, so we do welcome project sponsorship, research grants, contributions that facilitate our educational programs, scholarships for co-op interns and graduate students, and comparable project-oriented funding from manufacturers. The benefit for the end-user is a principle called academic freedom, in this case,

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

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

Besides, it does not take any money to see which printers and RIPs function as advertised and which don't. We saw one hyped printer grind to a halt, malfunction, or otherwise publicly display its incapacities 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 Sun LLC, Caldera, Raster Printers, LexJet, DigiFab, Barbieri electronic, Mutoh Europe, IP&I, Dilli, Yuhan-Kimberly, InkWin, GCC, Grapo, Durst, Teckwin 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. Now (in 2008), we are seeking corporate sponsorship so we can gradually make another 20% of our publications free to our readers.

Since 2006 we do a major part of our evaluations at a factory and headquarters demo room. Since the university does not fund any of these trips, it is traditional for the manufacturer to fund a research sponsorship. In the US this is how most university projects are initiated for decades now, and it is increasing. In fact there is a university in Austria that is not an "edu" but is a "GmbH", funded by the chamber of commerce of that part of Austria. In other words, a university as an educational institution, but functioning in the real world as an actual business. This is a sensible model.

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 half a million who read either our wide-format-printers.org site or our roughly half million combined who read our digital-photography.org and www.FineArtGicleePrinters.org sites.

Barbieri electronic (color management), Caldera (RIP), ColorSpan, DEC, Durst, Gerber, Grapo, IP&I, Mimaki USA, Mutoh, Dilli, GCC, NUR, Oce, Shiraz (RIP), Sun, Teckwin, VUTEK, Xerox, Yuhan-Kimberly, Zund have each brought FLAAR staff to their headquarters and printer factories. Bordeaux, InkWin and Sunflower ink have brought us to inspect their ink manufacturing facilities and demo rooms. We have visited the world headquarters and demo rooms of HP in Barcelona and received informative and helpful technology briefings. 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, Scitex, CreoScitex (now Kodak) and Cruse, both in Germany, have kindly provided scanners for our staff to evaluate.

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

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

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

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

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

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

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

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

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

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

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

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

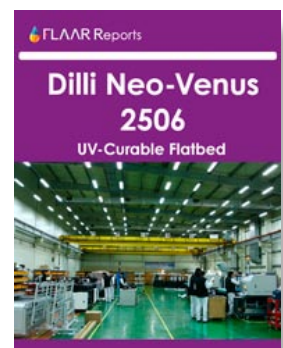
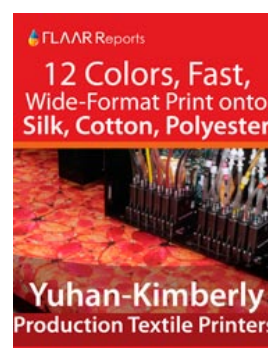
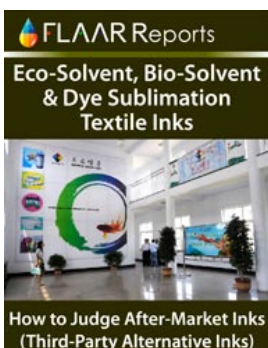
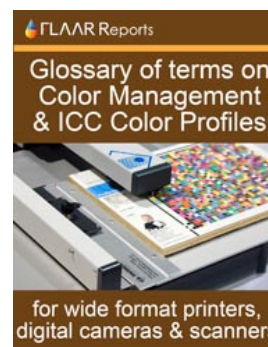
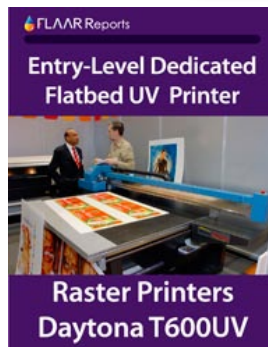
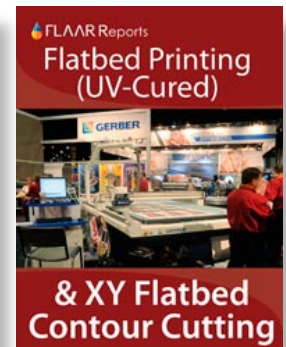
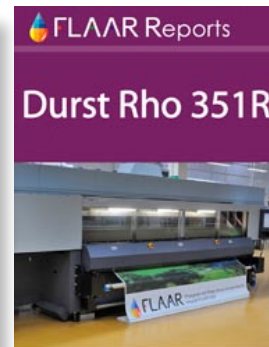
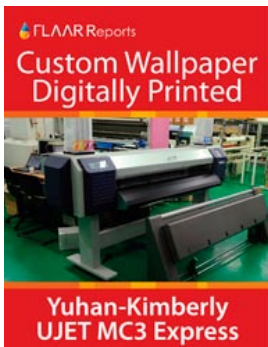
FLAAR also serves as consultants to Fortune 500 companies as well as smaller companies and individuals who seek help on which printers to consider when they need digital imaging hardware and software.

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

Free Sample Publications

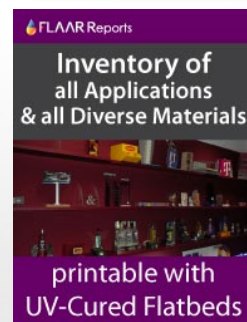
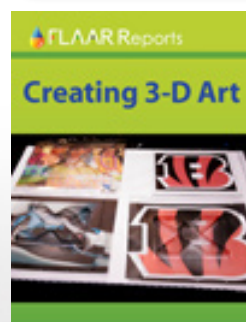
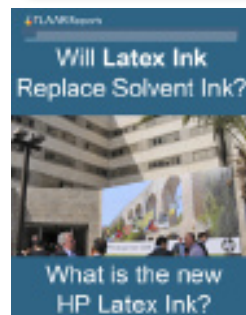
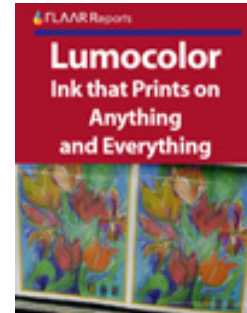
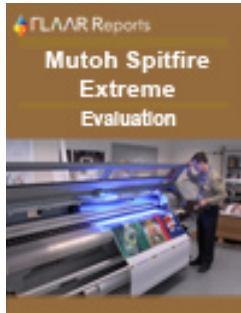
FLAAR Reports

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These FLAAR Reports

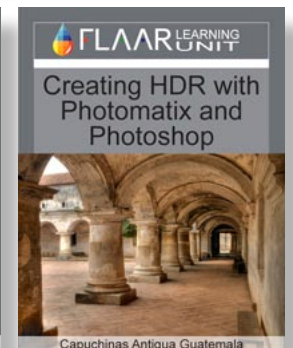
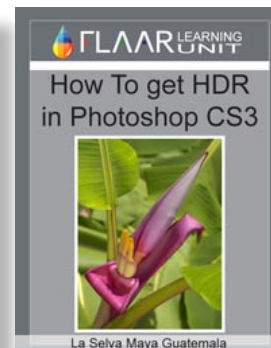
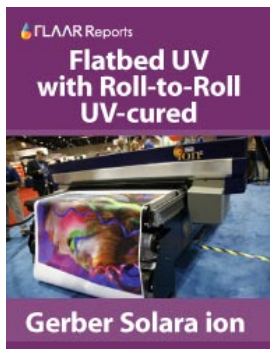
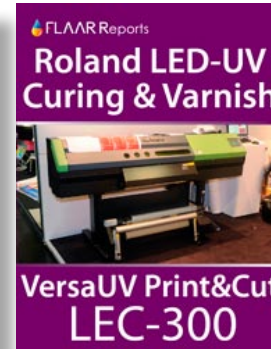
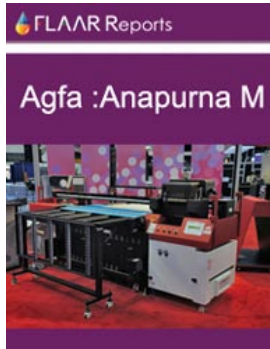
can be obtained at no cost by filling out the Survey-Inquiry Form, which you can find by clicking on the "Access to Survey for Free FLAAR Reports" link on www.wide-format-printers.NET



The advantages of filling out the FLAAR Survey-Inquiry Form are that you can receive multiple benefits: up to six additional different FLAAR Reports (at no cost) but titles you can't download without filling out the request form. Second, you get access to the digital imaging specialists of our partners who can answer your questions in person on the telephone.

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Each month Dr Nicholas Hellmuth travels around the world to investigate and learn more about the new technology.

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You can have more information at ReaderService@FLAAR.org