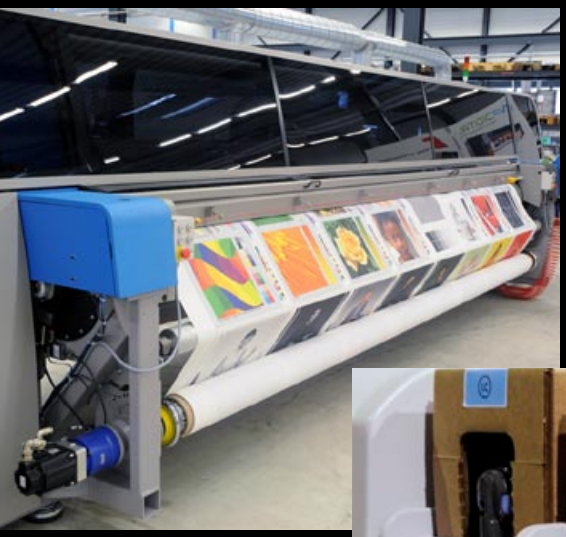
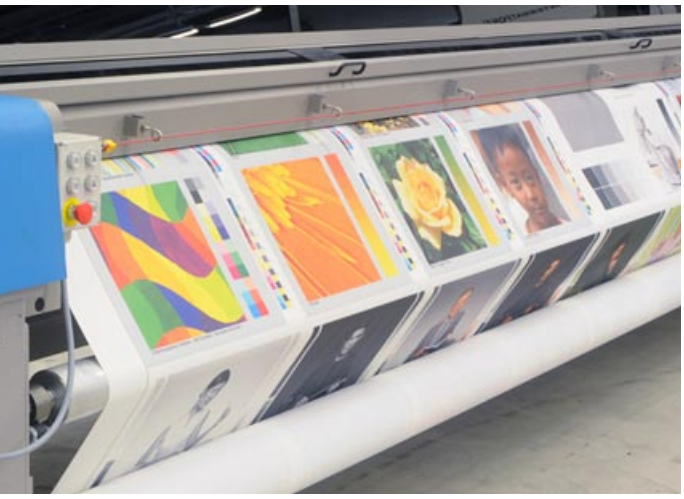
FLAAR Reports
May 2010
Dr. Nicholas Hellmuth

Which is better Resin ink or UV-cured Ink ?



Latex ink
What are the true Pros & Cons compared with Resin & UV inks?

With Sepiax resin & HP latex inks now available, is it viable to continue with full-solvent, eco-solvent, mild-solvent?



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Contents

Front cover photographs (left to right):
Virtu RR50 in WP Digital facilities (this page), HP latex ink cartridges close up, B&P Sepiax CADET SP750 at ISA 2010 trade show, and DGI PolaJet 3204D at ISA trade show.

FLAAR Reports

Comparing HP latex ink with UV-cured inks
Comparing with all solvent inks
and pros & cons of Sepiax Resin Inks

Introduction

The primary reason for researching and writing this special FLAAR Report is the advent of latex ink and then the discovery of Sepiax ink. Since Sepiax ink does not have the billion-dollar PR clout of HP latex ink, people don't have access to much independent knowledge about Sepiax ink.

Now that Sepiax ink has been featured at ISA sign expo and Sign UK there will be thousands more seeking information on how this ink compares with HP latex ink. The new distributors are unleashing their PR about Sepiax ink all during April, so now is the time to clear the air and base decisions on the basis of the reality of the ink (not the claims for the ink by promoters, nor the claims against Sepiax ink by companies selling solvent ink who see their market share eroded by the increasing success of both latex ink and Sepiax ink).

Many people who are thinking of purchasing a UV printer either already have a solvent ink printer or at least have seen plenty of them at trade shows. Solvent inkjet printers have been around for many years. In distinction UV-curable printers were only gradually introduced in 1999-2000 and were not being frequently delivered until about 2001; it was not until 2002-2003 that most UV-curable ink printers approached being out of beta stage.

Therefore the idea occurred to me that it might be helpful to compare UV printers to better known solvent ink printers. In this discussion solvent, mild-solvent and eco-solvent are treated as one class.

And now, since 2008, latex ink printers are becoming popular. So I thought it might be a good idea to compare and contrast latex ink to solvent ink to UV-cured ink.

Then since later in 2008, Sepiax water-based resin ink became known to the public; and now in 2010 Sepiax ink printers are available in many countries. So now I realized that a FLAAR Report could really be helpful on

- HP latex compared with Sepiax ink
- Sepiax and latex compared with solvent inks
- All compared and contrasted with UV-cured inks.

Neither ink is perfect; neither ink is all bad. Each of these inks offers good features but also has some downsides. This present FLAAR Report is being issued now (in May) because so many people have heard about Sepiax ink at GoA, ISA, and Sign UK. There is no outside evaluation, no independent discussion, so this FLAAR Report is to demonstrate our interest in encouraging ink companies to produce innovative products such as this ink.

We wish this report to be available before FESPA where the ink will have an international audience. Our intent is to inspect a major printshop that is using this ink as soon as possible. Until then, our comments are based on the experience that we clearly list in this introduction.

VUTEk PressVu 180 EC at SGIA 2002. Those were the early days of UV technology. The predecessor of this UV printer was a solvent printer.

If you know either class of ink well, and have other observations we have not thought of, please send us your suggestions so that we might include them in future updates: write FrontDesk@FLAAR.org.

Mimaki booth at Fespa Amsterdam 2009.

Roland booth at Fespa Amsterdam 2009.

Seiko booth at ISA 2009.

Latex ink
What are the true Pros & Cons ?
How does HP latex ink & UV-cured flatbed differ from a Solvent Inkjet Printer ?
And what about Sepiax ink ?

How many printers does this FLAAR Report Discuss?

There are about 45 manufacturers of UV-cured inkjet printers. Over 171 different models of UV printers have been introduced since 1998.

There are four main international manufacturers of eco- or mild solvent inkjet printers. VUTEk has stopped exhibiting their solvent printers at trade shows, so that leaves HP Scitex, Mimaki, Mutoh, Roland, and Seiko. D.G.I. in Korea should be added to create a Top 5. We don't count the scores of brands of Chinese printers since these don't last very long and every time they get introduced to North America or Western Europe the distributor drops them one or two years later. But there are more than 25 different models of all flavors of solvent printers from the main manufacturers who are not made-in-China.

For latex ink printers there is only one single brand: HP, and presently only two models: L65500 (104 inches) and L25500 (42 and 60 inches).

For Sepiax ink, presently there are two models of Mutoh printers that use Sepiax ink, but this ink can also be used in most standard Roland and Mimaki printers as well. Plus by SGIA 2010 I estimate that one or two major brands will announce special new printers specifically dedicated to Sepiax ink. By FESPA 2011 there will be printers using Spectra printheads that can use Sepiax ink. By DRUPA 2012 there will be a dozen printers featuring Sepiax ink.

By DRUPA 2016 UV-cured inks will have been overtaken by Sepiax and other developments that evolve from that new trend.

Sepiax ink being used in a Roland printer in the R&D facilities in Austria. Here Sepiax ink is printing directly onto uncoated canvas paper.

It would be interesting to see how the color gamut compares with Epson GS6000 and HP latex ink. Giclee ateliers have said neither of those are as good as a normal Epson Stylus Pro, Canon iPF, or HP Z3200 printer (don't blame me, this is the clear response from experienced giclee atelier specialists in color gamut). Sepiax is not specifically designed for giclee but I bet it will be usable for decor for sure.

How many kinds of inks are involved in this comparison?

For UV inks there are about eight major UV ink manufacturers and more than six different kinds of UV ink:

- Free-radical UV ink
  - Ink for dedicated flatbed, for non-flexible materials
  - Ink for roll-to-roll
  - Ink that is sort of half-and-half: a compromise ink for general purposes
  - Very flexible UV ink: for vehicle wrap
  - UV ink for thermo-forming
  - Ink that can accept LED curing
- Water-based UV ink (Sensient, not yet finished, used for textiles)
- Cationic UV ink

For solvent inks the main kinds are

- Full-solvent
- Mild-solvent (also called lite-solvent)
- Eco-solvent
- Bio-solvent (made by Inkware of EFI (VUTEk)), used only by one model of Mutoh hybrid

HP latex ink (called "water-based" but that tag is debated by some competitors).

- After-market third-party latex ink

Unique water-based inks, such as Sepiax.

There are other experimental inks of each of these classes. There was an alcohol-based ink (Kiian, Manoukian, Tricksy), but this ink has disappeared from the scene. There is one additional alcohol-based ink being developed by a company other than Kiian, namely Jetbest. Downside is that alcohol can wipe it off.

And there are some innovative textile inks: Sensient and Yuhan-Kimberly. Plus there are new inks such as one for glass that I just heard about in Germany. But the present FLAAR Report is concentrating on comparing and contrasting UV-cured inks, solvent inks, Sepiax resin ink, and latex inks.

Comparisons: Solvent printers compared with UV printers: Hybrid class

Hybrid UV printer means it has pinch rollers and grit rollers associated with a stationary platen. To handle flat materials you add a table at the front and a table at the back.

95% of all solvent printers less than 3.2 meters in width have the same grit-roller pinch-roller system as do hybrid UV printers (except that the UV versions and the Mutoh Bio-solvent hybrid add the tables front and back). Almost all UV printers have some kind of flatbed capability. Only a few solvent ink printers have flatbed options. Most of the solvent flatbed printers 2007-2010 are manufactured (and used) primarily China and mainly because they are cheaper than UV printers.

Only a few hybrid UV printers have two sets of pinch-over-grit rollers: Teckwin and Hi-Jet Digital (Rodin) two such models. The Zünd 250 was the most sophisticated model that offered two sets of pinch-over-grit rollers. The second set is an attempt to hold thick flat material so that the entire board can be easily fed and printed to its end. But in general, hybrid flatbeds even with two sets of grit rollers have failed to impress people with much performance potential.

About a third of UV printers are exclusively flatbed (Inca/Sericol, for example). The Oce Arizona 220 is one of the few wide format flatbed solvent ink printers that has no roll to roll option. An exception are several brands of Chinese-made dedicated flatbed solvent printers (with vacuum tables). Most (but not all) current-model Chinese dedicated flatbed solvent printers are attempts to learn flatbed technology so later these can be turned into a UV-curable flatbed when the Chinese company has more experience. The Kincolor solvent ink flatbeds are an example.

The other flatbed solvent ink printers that have no roll-fed capability, primarily from Korea, China, Taiwan, or Japan, are less than 24". This means they are desktop printers, to sit up on a table.

Oce made one flatbed (mentioned above) that was available with either solvent or UV inks (one, or the other, but not both simultaneously). But many portions on that printer are similar in the sense the media was stationary. The UV version was named Oce Arizona T220uv.

But even when a solvent printer and a UV printer share the same structure and the same chassis, all the ink plumbing and ink tubes must be improved to handle the heat and the chemistry of the UV ink. Early Chinese UV printers did not realize this. Early eco-solvent printers (many years ago) also did not realize that each ink requires a different kind of tubing and fittings: early eco-solvent ink dissolved some of the fittings since the first Rolands were made to handle water-based inks. It took about a year to figure all this out.

No latex ink printer offers hybrid flatbed capability because the curing heaters and blowers need to be in certain positions relative to the surfaces of the material. In other words, the current latex ink chemistry works only for thin and roll-to-roll materials.

Sepiax ink (water-based) and alcohol-based inks work on thick rigid materials in addition to roll-fed materials. Indeed one of the best printers for Sepiax ink currently is the hybrid version of the Mutoh ValueJet. Why? Because the hybrid version has added a hot-air system onto the printhead carriage (at the left). So there is hot air blowing down onto the printing surface the same time that the ink is jetting. The regular ValueJet printers do not have this feature.

Why does is the hybrid version of the Mutoh different? Because MuBIO ink requires certain kinds of heating. By sheer coincidence, Sepiax ink is happy with the same kind of heating as the MuBIO (not identical requirements, but close). Unfortunately the hybrid structure of UV printers has not been successful for thick and rigid materials because of limitations in the ability of pinch rollers to move heavy or slippery material. There is an entire separate FLAAR Report on why hybrid printers will never again be successful for handling thick or rigid materials.

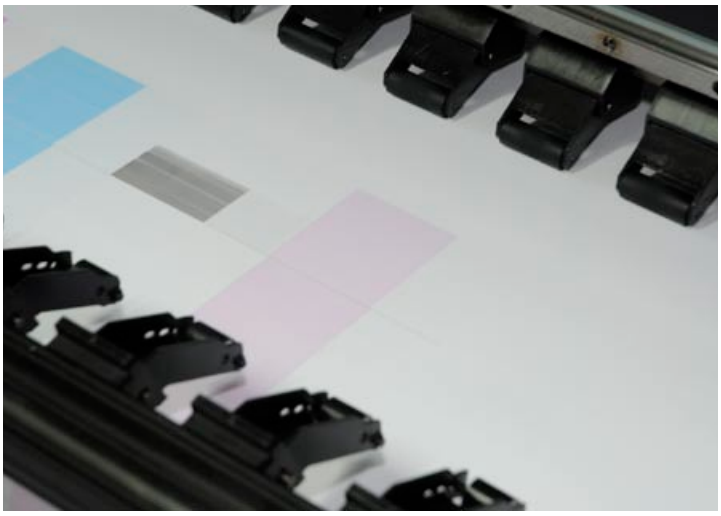
DuPont Cromaprint 18uv at ISA '07. This is a UV hybrid printer.

The tables that are necessary for UV hybrid printers have various design concepts to move rigid media into the enclosed printing area. You can have cylinder-shaped rollers inset into a flat table, or spherical-shaped rollers set into a flat table. Most tables though are made of many parallel rows of roller bars.

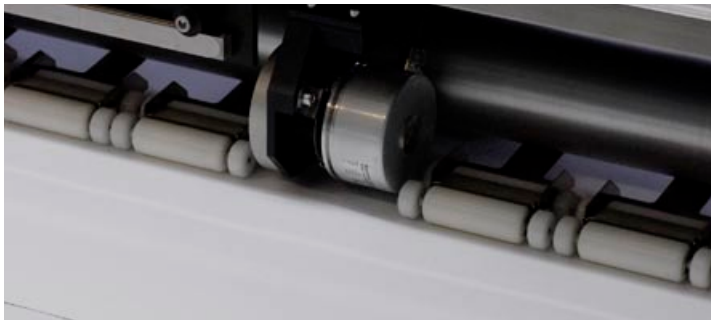
1. This printer first appeared as a solvent ink printer only. Then a year later it was issued as a UV-curable ink printer. I am not sure whether the solvent version is still available. Now that UV inks are available there is not as much incentive to use solvent inks.

UV Hybrid printers that have Dual Pinch Roller System

Teckwin TeckSmart UV1600



Zund UVjet 250 Combi



Teckwin TeckSmart 1600UV (left) and Zund UVjet 250 Combi (right), at their respective factories. FLAAR classifies these as hybrid machines, although not all companies follow the same criteria to categorize their printers, as you see in the "Combi" of Zund. These are the only UV hybrid printers we know with a second row of pinch rollers (pointed with arrows).

The Océ Arizona 220 was designed as a dedicated flatbed (only to print rigid materials), without the roll-to-roll option.

HP Designjet L65500 printer, at ISA 09. In the exploded view you can see that this printer is a dedicated roll-to-roll (handles only flexible media) like all latex printers at the moment.

Preparing the substrate to receive the ink

Traditional signage substrates for solvent ink such as vinyl don't usually have to be treated to receive full-strength solvent ink. But non-absorbent (rigid) materials are rarely printed with solvent ink. No flatbed printer that uses solvent ink has been successful in North America, so not even primers are adequate.

The first two generations of eco-solvent ink had the most limited range of suitable roll to roll materials of all (despite what ads claimed). In other words, even roll to roll materials for eco-solvent required coating. Today, with the fourth generation of inks, there are more materials that don't require coating, but there are also more coated materials for eco-solvent ink as well.

In other words, although vinyl and some signage materials work well with full-strength solvent inks, there was one ill-fated hybrid flatbed mild-solvent printer, circa 2003-2005, that only functioned with three or fewer materials! Yet this was proudly launched at ISA and SGIA in the US in those years. In fact the booth personnel were unexpectedly honest when they listed the only one or two (or at most three) rigid materials that worked with that solvent ink.

That flatbed solvent printer disappeared very quickly thereafter. But then bio-solvent was introduced, also on a hybrid-based printer. Most analysts suggested that alcohol could sometimes wipe the ink off. Whatever the reason, it is noteworthy that this bio-solvent hybrid flatbed disappeared for a year or so, then recently reappeared again. I admire their perseverance. Indeed it was FLAAR that wrote the first articles on the potential of bio-solvent ink after the first generation came out. But our interest in our initial comments was in the green aspects, not on whether it would wipe off some materials with some solvents.

But until I can test it on a wide range of materials, and do a scratch and alcohol and Windex (ammonia) wipe tests, I would be cautious with any solvent ink for any flatbed. 90% of the manufacturers (outside China) who started with a flatbed or hybrid solvent printer, once their chemists and engineers mastered UV-curing technology, they quickly and permanently dropped any attempts at trying a flatbed using solvent ink (this does not mean that solvent or eco-solvent, or mild-solvent inks don't work; it only means that 90% of the companies have not tried to keep attempting with solvent ink to print on flat materials).

Where flatbeds have potential, however, is with the various atypical inks (Staedtler, "Miracle, "and others). It would be great to see Mutoh Europe, Mutoh America, or Mutoh Japan be leaders in adopting some of the really innovative inks that exist since 2008, plus the other remarkable ink that may be revealed in 2009. Each new innovative ink failed because printer manufacturers and the ink companies refused to work as a team. The ink companies declined to tweak their inks and the printer companies declined to tweak their printers.

The best place to see successful flatbed printers that use unusual and innovative inks is in Europe.

Same with UV printers: basic signage materials print okay in raw untreated form, but glass and other slippery surfaces require a primer and/or a subsequent top coat. One major brand of UV ink cannot adhere acceptably to Coroplast (fluted plastic), so any company that uses this brand UV ink require an adhesion promotor (a primer) to be applied to the Coroplast.

Diana Dogaru, the first step in glass preparation: cleaning glass. (First step is to wipe the glass clean with a rag and appropriate cleaning fluid).

Coroplast is one of the substrates that requires pre-treatment with at least one major brand of UV ink. With this one brand of ink, unless Coroplast is pre-primed by hand or spray in your shop, the ink will tend to fall off the Coroplast in a few weeks (if not sooner).

This same brand of UV ink flakes off when printed on Sintra and you cut the edges of the Sintra. Fortunately other brands of UV ink are better in these respects. This is why the FLAAR Reports are helpful, as otherwise it would be unclear which inks work on which materials. But all inks get better, and the newer versions of that ink will eventually be able to hold up on a wider range of substrates.

Some materials need to be corona treated, flame treated or treated with a primer (spray or brush-coated) before being printed on with UV-cured ink. If you don't treat these materials the ink will not adhere well.

Do substrates require coating?

HP documentation states Latex will work on coated and uncoated media. But, then why do some materials still need to be treated or coated to accept latex ink. DuPont Tyvek is one such material. But there are other inks that work on Tyvek with no treatment: Sepiax ink is one of these. HP cleverly calls their DuPont Tyvek as "treated" not coated. But whatever wordsmithing you use, it means the Tyvek for latex ink is more costly than untreated.

And why does HP not tell you what "treatment" means. Is it corona treatment? If so, this does not last very long (6 to 12 months).

Most substrates work acceptably with Sepiax ink with no inkjet receptor coating and no primer. But several substrates which do print okay with nothing, do look better quality if they do have an inkjet receptor layer.

Someone mentioned "Mesh needs coating" for latex. But possibly they meant that no mesh kit was available and so mesh needed a backing. Whether it also requires a coating I am not sure, and am checking.

- PE is coated (HDPE); not corona treated
- Banner and self-adhesive vinyl need no coating for latex.

For eco-solvent more materials are coated than Roland, Mutoh, and Mimaki would like to advertise.

Solvent ink will not wet onto PE. You need to corona treat the PE before printing. Corona treatment raises the dyne level of the surface of the PE. But this charge wears off over time (six months to a year).

UV can print on non-coated material, hence cheap material. You can print onto untreated PE with UV ink. But some brands of UV ink do require primers: Sericol UV ink needs more primers than some other brands.

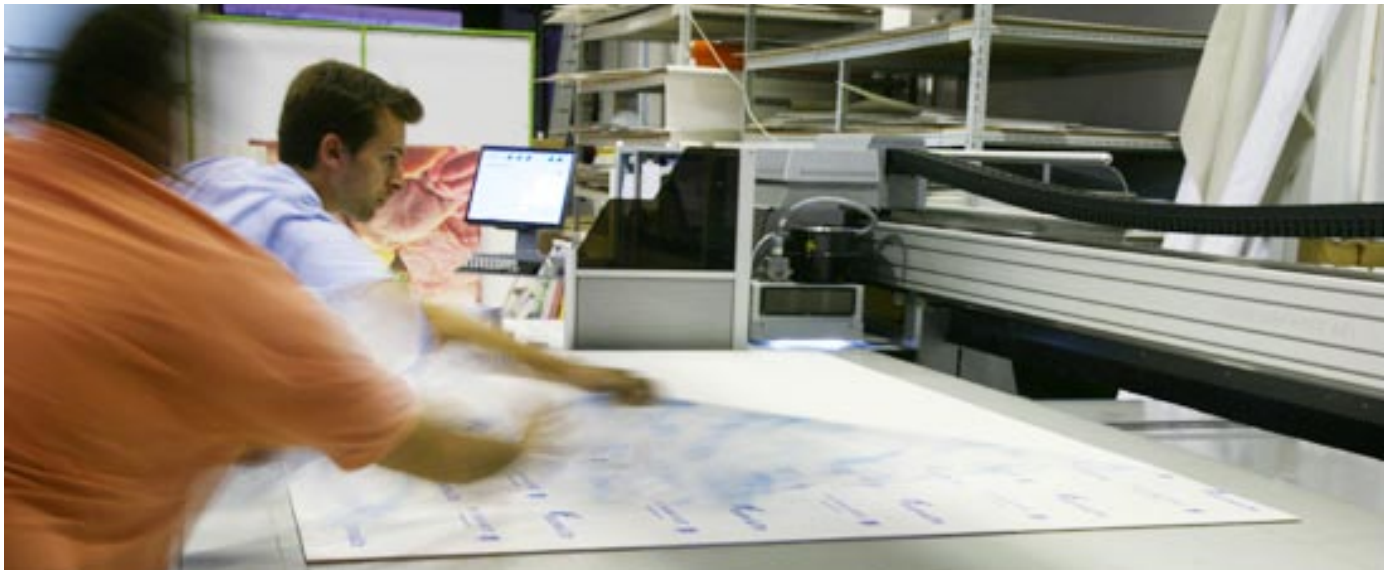
Cleanliness of the material in order to receive the ink

Materials for receiving UV-cured ink must be totally clean: no dust, and especially no oil, including finger oil. Some materials need to be wiped with ISP (Isopropyl) alcohol, yet if you wipe other materials with alcohol this may occasionally cause problems with ink adhesion.

If the alcohol has too much water in it, this causes problems as well, since the high heat of the lamps causes the water (within the material) to heat up.



Aluminum boards being cleaned to be printed on.



Some materials for UV printers are so delicate that come covered with a plastic skin. In this sequence you see the removing of the covering.

Printing on Cheap materials such as paper

Other than blueback paper (which is a common signage material), I doubt that most cheap paper would print well with solvent inks; cheap paper does not do well with water-based inks either. But cheap paper works okay with UV-cured inks as long as the curing lamps are not too hot, and cheap paper works with water-based (non-UV) Lumocolor ink from Staedtler. But obviously you would normally not use a cheap paper unless you desire some special artistic effect.

UV ink can probably print on a more diverse range of materials than most other inks. But some other inks can handle cheap materials even better: Sepiax ink and Staedtler Lumocolor ink: actually both these are water-based (not UV and not solvent).

Kiian alcohol-based ink could also print on a really wide range of materials (as shown at SGIA 2008). But this ink was never exhibited after VISCOM 2008.

Latex ink, so far, prints only on a limited range of signage materials: not on décor materials or exotic materials. Because of the extreme heat, many thin materials will not print well inside a latex ink printer.

Sepiax ink works fine on cheap paper, though like most inks, a coated paper is even nicer. With Sepiax ink you can even print on paper napkins!

Dr. Nicholas Hellmuth holding Sepiax print samples at Graphics One booth, ISA 2010 trade show

Abrasion

Because the solvent ink is "inside" the vinyl substrate, it does not tend to abrade easily off vinyl.

But UV ink is only on the surface, so it can scratch more easily. Indeed UV ink is infamous for scratching easily off many materials. Or, sometimes UV ink will print well and stick acceptably the first month or so, but then simply fall off later (see adhesion aspects, next).

Abrasion and adhesion tests for Sepiax are still being undertaken (so we are waiting for test results), but so far Sepiax seems to work better than any previous "miracle" or "magic" ink (definitely better than Staedtler Lumocolor ink from Germany).

In the Sepiax booth at Sign & Digital UK I watched people trying to scratch the ink off with their fingernails. No scratch marks (other than their nail powder….). In other words, the ink was just fine.

I have tried to scratch off the ink and it did not scratch off even from aluminum. But realize this is after the 24-hour curing time. Most inks, fresh out of the printer, can be scratched. Even UV-cured and even solvent inks take a while to set firmly.

Solvent Resistance

Solvents will naturally tend to dissolve solvent ink.

Some solvents will not tend to mar most well-cured UV-curable inks.

Lamination and other surface protection

Images on solvent ink are either sometimes laminated or sometimes not; for example self-adhesive may be laminated, depends on climate and application location.

But UV cured images may require varnishing or other surface protection to protect against abrasion, scratching, cleaning solvents, and other hazards of daily usage. Solvent ink tends to be more resistant to abrasion and usage in general. UV ink is fragile, more so on flexible or smooth surfaces. Eco-solvent can print on many surfaces but may not adhere as well as true solvent inks.

Floor graphics would tend to need to be laminated whether printed with solvent ink or UV ink. Vehicle graphics may tend to be laminated too, but until 2007, most UV inks were not flexible enough to fit around rivets or sharp corners on a vehicle. Today, in 2009, several special UV inks can be used for vehicle wrap.

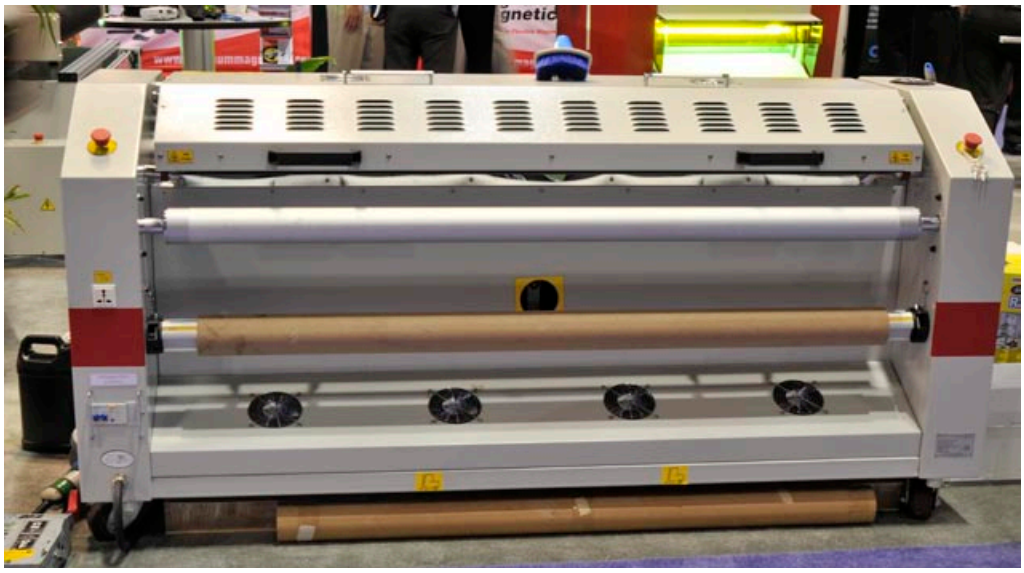
Here you can see an example of how some materials need to have a top coat after printing on them to avoid ink fall off.

The other benefit of lamination for UV printed material is removing bi-directional banding (the lawnmower effect).

Another advantage of lamination for UV prints is to add extra gloss. However I would estimate that 90%, or more, of UV prints never need to be laminated. One exception may be UV prints that are LED cured. Roland is cleverly putting a top coat over every test print that they show at a trade show with their UV printer. So far I have not seen them allowing an uncoated print to be tested. But top coating in-line is not the same as laminating. Top coating primarily keeps you from being able to smear an uncured UV ink. In general, for a narrow-format UV printer, the Roland concept is interesting for labels and comparable work in markets that Roland is well known in.

In the HP booth at Japan Shop, Tokyo 2010, Neshen had large ad for Jet Shield Laminate. Since the same entire HP booth was featuring only latex ink, this raises the question of whether latex ink requires lamination in some instances. Vehicle wrap for sure requires lamination for latex ink.

There is a lot to study for Sepiax ink, for applications such as vehicle wrap. But you can laminate it, reportedly right out of the printer (reportedly no need to 24-hour cure before laminating).



Lamination equipment exhibited at ISA 2010

Adhesion

Heating the vinyl substrate opens the material so the (full strength) solvent ink "eats" its way into the vinyl. This adheres the full-solvent ink to the substrate. Heat and/or hot air then drive off the solvents (which create VOCs) but which leave the pigments inside the surface of the vinyl to provide the attractive color for billboards and banners.

But adhesion of bio-solvent and eco-solvent inks may vary from okay to poor on some materials (and some materials may need to be coated with primer).

UV ink is printed primarily on a solid material or otherwise unheated in any event. So the solvent ink bonding is not possible. Then the UV ink shrinks anywhere from 5% or 10% or a bit more, as the ink cures. This shrinkage is not good for firm adhesion. Baker (2002) mentions other problems in curing thick layers of ink, such as wrinkling.

To handle the adhesion aspect, many materials need to be treated. Glass is one. In the booth of WP Digital you can learn about this process: cleaning, heat-treating, using a primer. The WP Digital team can explain to you their fully developed process for printing on glass with their Virtu RS25 and Virtu RS35 printers.

Adhesion and scratch resistance are some of the aspects being evaluated by FLAAR to determine the quality of the UV ink used by a printer. In this photo, Dr. Nicholas Hellmuth is testing a print sample with a ballpoint pen.

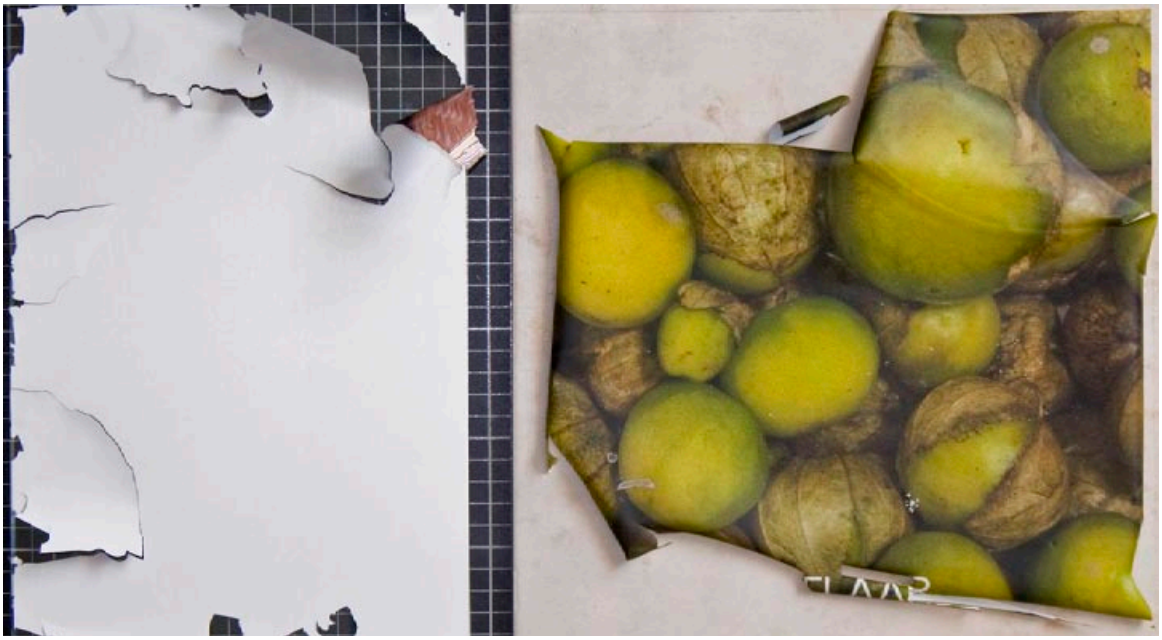
Potential adhesion problems when re-heated long after printing

By mistake one of our prints from a Gandinnovations printer was on top of a micro-wave oven. The ink came off.

We received a second hand comment that with LG bought 24 UV printers from DYSS, that LG was a bit upset when the ink began to come off after the LEDs had been turned on for 100 hours. So I am wondering if the LG situation with DYSS printers is comparable to our microwave accident?

I have never heard of this with other inks since heating the printed substrate is not a standard test. But perhaps we might wish to add this test.

Floor tiles were printed on as part of a FLAAR evaluation in the Gandinnovations UV printer manufacturing plant. Months later one of the floor tiles had begun to peel off (in part because it had been put on top of a mini kitchen oven).



The floor tile from the previous page is not the only case where the UV ink layer began to peel off.

Chipping at the edge, when the edge is cut

With UV ink from some brands if you cut the material on which you printed, the edge of the ink coat will chip or flake off. This is a known issue for one oft-used brand of ink on Sintra. But this same ink is a well known brand, and has other features which are positive. Plus every year all brands of ink get better. So by the time that you read this, that ink will surely be better than it was a year ago.

Ink

Inkjet inks in general—whether UV, solvent, Sepiax or Latex—need to have a low viscosity (varies by which ink and which printhead) to be properly jetted off the printheads. This low viscosity means the ink has a high mobility on top of the media, which is directly related to the print quality.

On top of some substrates, you might face several problems such as bleeding, mottle, dot gain and other issues that are visible on the surface. Solvent, water-based, and UV ink printers are mature enough to have resolved these issues when an adequate RIP software and ICC color profiles are used, when temperature is even across the material, and when the electronics are of professional international standard (low-bid electronics, cheap ink, and inadequate RIP software will cause a host of issues no matter what ink chemistry you use: including latex and Sepiax resin inks).

Solvent ink has to dry off the mass of liquid solvents which are the vehicle for the colored pigments. When printing on vinyl this process is relatively straight forward (you heat the vinyl before printing to open up the pores of the vinyl to receive the ink and after printing to drive off the mass of solvents: leaving the colored pigments). But when you print onto a solid, such as marble, ceramic tile, then there is no quick way for the solvent to evaporate. With wood you have a further problem of potential staining. And even though vinyl can handle the mass of liquid solvents, it continues to outgas for days and sometimes weeks. The outgassing has an aggressive and distinctly unpleasant odor.

In distinction UV ink turns into a solid form instantly (the UV light cures the liquid ink into a solid film within milliseconds). So the UV ink does not soak into anything. This advantage also has a slight downside in that each drop stays as an individual drop of ink on top of the surface of the material, rather than merging with other drops; the best example of how merging results in continuous tone would be thermal dye transfer which produces the best quality images of any wide format process (from wax ribbons; this ink is not jetted through a nozzle, it is heat-stimulated off a wax ribbon by a heating element pixel by pixel. Each heating element is approximately the size of each pixel).

UV ink does not evaporate (or at least not in the same degree as the water in ink for Encad, Canon, Epson or HP). Most current UV ink does not give off solvents as do all solvent ink printers (and eco-solvent too).

In theory, UV ink cures only when exposed to UV light. But in reality UV ink can gel if exposed to high temperatures. UV ink will tend to gel if in the heated printhead too long (the printhead has to be heated in order to lower the viscosity of the ink so it will jet appropriately). Or the ink can be inadvertently exposed to heat elsewhere in the printer.

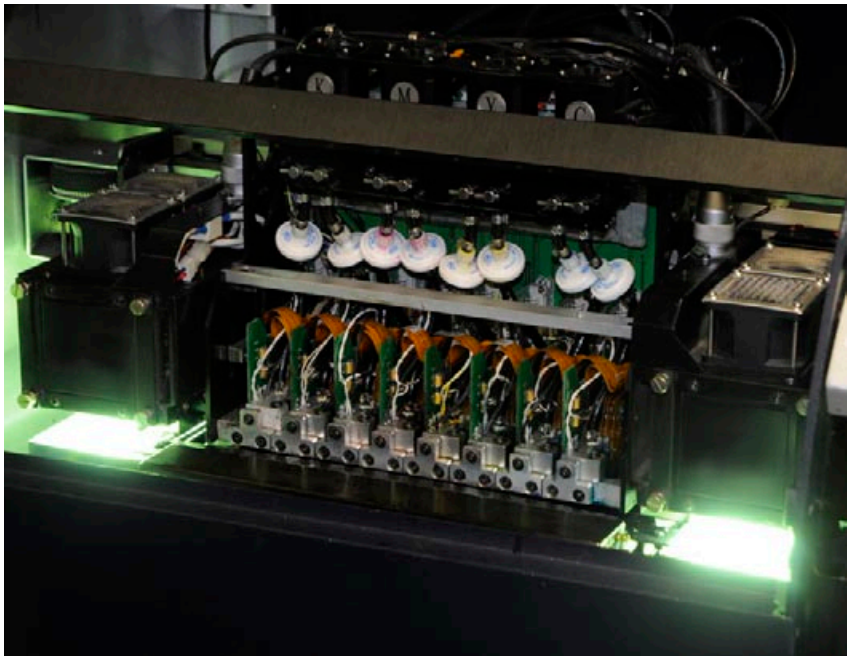
A solvent printer is characterized by having a drying mechanism in the front to evaporate the remaining solvent that is the vehicle of the pigments of the ink.

One of the reasons you will see most UV printers use black containers and black tubing is because sunlight can gel the ink. UV ink can even gel from internal heat within the printer. Latex ink and resin ink are too new to fully see any subtle issues of this nature (curing within the ink tanks or rubbing).

Solvent ink of course loves to harden in the nozzles ! For years UV printer manufacturers have used that known fact to try to sell UV-curing solutions. But UV-cured ink clogs printheads more than any manufacturer cares to admit (some printhead brands and droplet sizes clog worse than others).

Something else about curing UV ink is that when the ink drops are piled up on top of one another, the ink at the bottom may not cure thoroughly. And black ink is the toughest to cure.

So when printshop owners and printer operators say they just want to learn about actual production speeds and ROI, our more global viewpoint suggests that it is helpful to receive a good general introduction.



The essence of a UV printer is the ink curing (or drying) process. Ink is solidified with UV light radiated by the lamps. The downside is that UV light can damage your eyes if not properly protected. Most hoods are okay, but a printer with no hood could be seriously dangerous to the eyes of your operator. If someone says, "our UV light meets EU requirements" then perhaps those EU requirements are inadequate to protect your eyes if you are next to the printer all day all month all year. The photo here, however, is taken with the hood up. This printer has a nice hood, and when in down position, you would not see this much light..

The big advantage of UV printers over solvent printers is the ability to print on rigid materials. Samples printed on Dibond boards with the WP Digital Virtu RS35 UV combo printer.

Color Gamut

Solvent ink can hit most desired colors though I have seen poor color with some really cheap solvent printers (I assume using cheap ink too).

- UV ink used to be poor in reds; some UV printers could produce only a range of orange: not enough true reds.
- UV ink has a bias towards magenta.
- Most UV ink mixes greens with yellows; and yellows look greenish. The greens look too yellow.
- The best colors with all UV inks are cyan and blues, metallic colors (such as watches) and earth colors.

But, as you noticed in comments on other aspects of UV-cured inkjet printers, the color gamut aspect of UV printers better each year, but is still nowhere near as good as solvent ink colors.

Some HP latex ink colors are good:

- Yellow
- Blue of sky
- But turquoise blue of water was unnatural-looking

WP Virtu RR50 print sample. You can see the wide range of color gamut.

But upon close inspection and comparison, HP latex ink colors are not as good as I would have expected. I had hoped their color gamut would be complete, but more and more people with experience with HP latex ink are commenting that this ink has a few colors that it can't hit well:

- Red may be a bit orange
- Skin tones unnatural (but probably a bad photo: HP booth, Japan Shop, Tokyo 2010).
- Some blues very saturated (this is not a compliment!).

But why are poor colors produced in an official HP booth ! The HP booth at a recent trade show was producing inadequate colors (and was using a few uninspiring images). Any time you ask discretely about the latex ink color gamut, an honest printer operator will admit that some colors are tough to achieve.

Roland booth Japan Shop 2010

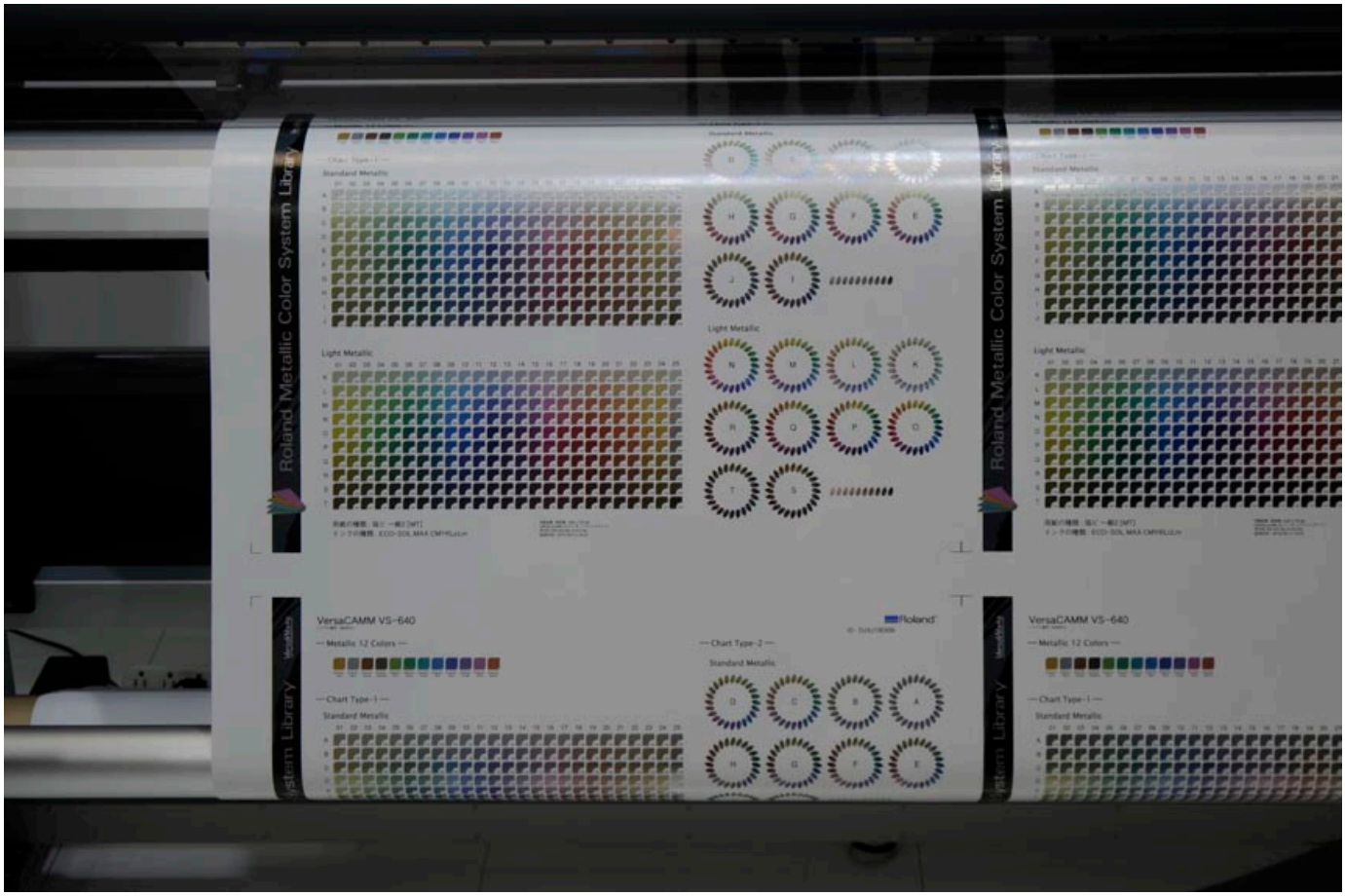
Metallic inks

UV inks produce excellent metallic colors and many metallic effects materials can be printed on with UV inks.

Roland and Mimaki both offer metallic effects eco-solvent inks.

There are no metallic inks for HP latex printers.

Sepiax ink does not yet offer specific metallic colors.



Roland metallic printed samples at Japan Shop 2010.

White ink

I don't know any solvent printer prior to 2008 that offered white ink that actually was opaque enough to work acceptable other than the new white ink of Mimaki. The Mimaki print-and-cut series now offers an improved white ink (as of 2008).

Roland offered a white eco-solvent ink several years ago but it was not opaque enough to be practical in that early first try. Now Roland offers a new generation improved white ink, but Mimaki is still a bit ahead in white ink for eco-solvent chemistry. Whether these new white solvent inks win back business lost to white UV ink remains to be seen.

White ink is readily available on about half of the better UV printers. Creon Azero and Durst Rho printers were among early adapters of white UV ink. Just realize that normally it helps to have two different printheads dedicated to using white ink. However still in 2010 the white ink on some UV-cured printers is iffy at best, especially since white ink may prefer a larger picoliter drop size (so one model of printheads for CMYK and perhaps a separate model of printhead with larger drop size for the white ink). And the general rule is to use two printheads for white.

UV roll to roll machines can print white ink on material for backlit signage. The same white ink can also be used on black rigid material. Since 2009, WP Digital Virtu, Gandinnovations, Dilli, IP&I, GCC, VUTEk and most brands of UV printers offer white ink. Indeed the availability of white ink is one good reason to consider a UV printer for backlit material.

No white ink is available for most full-solvent ink, only for eco-solvent.

No white ink is available for HP latex ink.

Sepiax ink does not yet offer white ink.

Frankly white ink is not used in the real world often enough to warrant adding white color to most ink sets. In most cases you will achieve better production with white if you have an in-line white coater, such as Drytac offers. A white coater may provide better quality than trying to surive all the issues with attempting to jet Titanium dioxide with an inkjet printhead.

Nicholas Hellmuth (FLAAR) with white ink print sample at VUTEK booth, ISA 2008 trade show.

Drytac VERSA Coater Multipro at Drytac booth, ISA 2010 trade show.

Applications in general

Every single HP press release; all HP advertisements claim latex ink can accomplish more applications than mild-solvent, more than eco-solvent, and more than water-based inks!

Clearly whoever wrote this stuff knew nothing about resin ink in general and from Sepiax in particular.

Besides, I am not convinced that latex ink can print on more materials than solvent inks. Latex ink is definitely not as useful in multiple applications as is UV-cured ink.

And I bet Sepiax resin ink can beat most lists of applications (potentially DOUBLE that of latex ink).

Applications: Heat Transfer

For example, with Sepiax ink you can heat transfer to coffee mugs. Hmmm, can you do that with latex ink?

A special film printed with Sepiax inks was stoved into a ceramic part.
This was done by low temperature stoving with 220°C.

Thermo-forming (on a wooden mold)

One kind of solvent ink can be thermo-formed. Oce sold a special printer and ink solution for this seven years ago. But this was a special ink; normal solvent ink is not usually thermo-formed.

Several UV-cured inks can be thermo-formed, from 2 cm to 6 cm in dimension (depending on which brand of UV ink you select).

Sepiax ink can be thermo formed at least 1 cm.

I am not familiar with thermo-formability for HP latex ink.

After-market ink

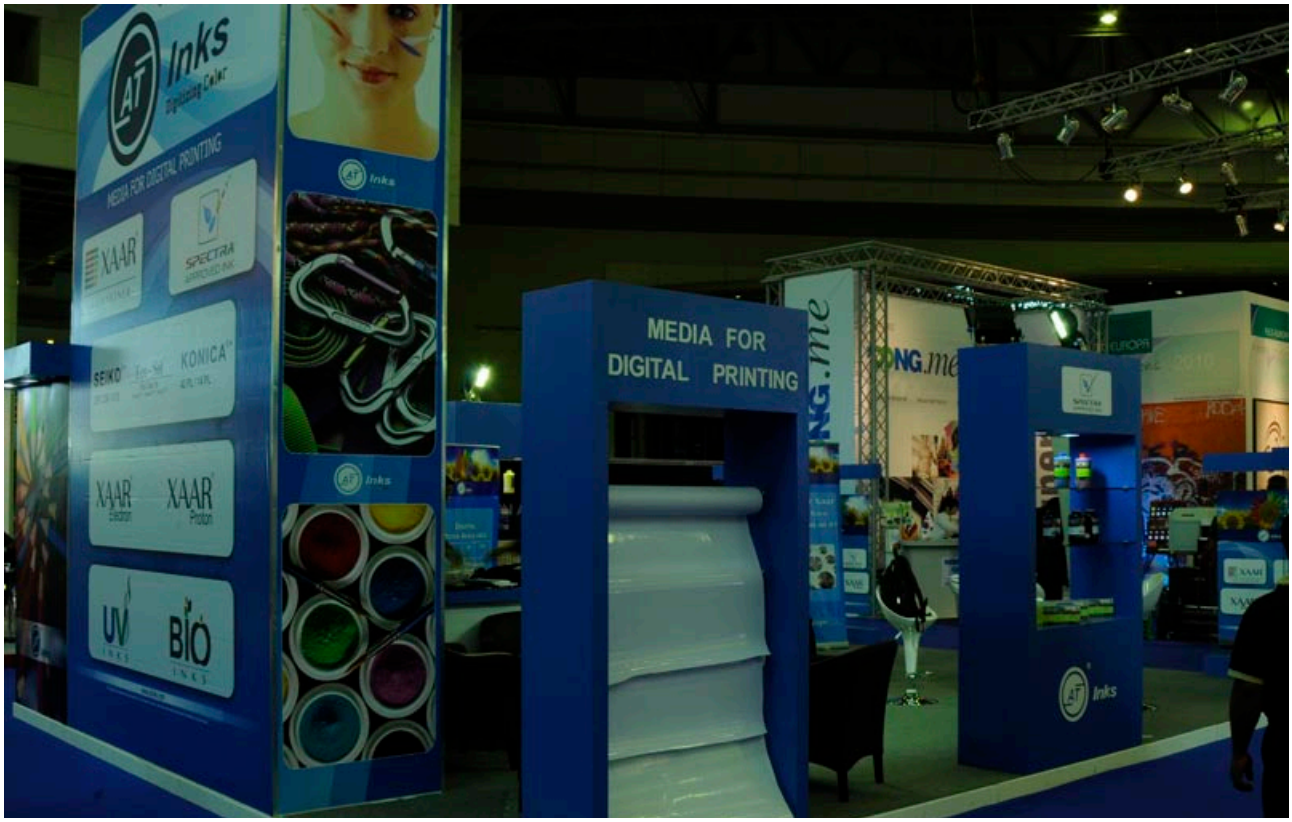
After-market solvent ink is readily available.

Not much after-market UV ink is currently available that an end-user would seriously be tempted to use. Although some solvent ink from the printer manufacturer is high-priced, after-market solvent ink is quite low cost. UV-curable ink is inherently more expensive. But most end-users would not risk using a non-certified after-market UV ink.

Triangle is rumored to have an after-market "latex" ink. Whether it is ready to be shown at FESPA 2010 is unclear.

In at least one country in Europe the Sepiax ink is sold under a separate brand name. Frankly this is confusing to use an additional name. Plus the new separate name will miss out on all the positive reputation that is being acquired by Sepiax under its own brand name.

If there eventually is an after-market ink that attempts to emulate Sepiax ink, this would not interest me very much. I would much rather see another company be innovative and do a different kind of wonderful ink. The Kiian ink and the Jetbest inks are good examples of inks that FLAAR was interested in helping their ink become better known. But since both are alcohol-based inks, I have not yet detected any widespread acceptance in the overall signage industry.



AT Inks is an example of a good third-party after-market eco-solvent ink.

Occasional changes of ink chemistry

Because solvent ink is a mature technology, the ink tends not to change much from month to month. But the first generation of eco-solvent inks 2002-2003 were inadequate, so the formula changed. The chemists are probably still juggling formulas to improve it.

UV inks may change formula once or twice a year as chemists gain more experience with this new technology.

Any change of ink chemistry means that you must re-do all your ICC color profiles.

Ink odor: Solvent compared with UV

The only smell worse than full solvent inkjet ink is ink for screen printing machines.

UV ink, in distinction, is not as unpleasant, but with a dozen brands of UV ink, one or two brands have built up a reputation for having a rather nasty smell. So be sure that your printshop has adequate ventilation.

And be sure that your printer has vent openings in the top of the printer. These vent openings can also help get rid of ozone and possibly some of the misting ink as well.

Advertisements for UV-curing printers attempt to claim how much better their ink is than foul-smelling solvent ink. But more and more, people are recognizing that clients are refusing to accept printshops for interior decoration if printed with UV printers because of the weeks or sometimes months of odor.

Anyone who works in a UV printshop every day will be accustomed to the odor of UV-cured inks. But if you are in a restaurant and every table top in the restaurant was printed last week with UV-cured ink, if you have never experienced the smell, it might make you lose your appetite for dinner in that restaurant.

One of the main advantages of UV-cured printers is the ability to print both rigid and flexible media. Here, Dr. Nicholas Hellmuth and Curt Brey at Gerber demo room.

There are a dozen brands of UV-cured ink and each has a slightly different smell; Tech Ink was considered the worst (it is now a bit improved in the stink category). And some brands of UV inks are nowhere near as bad. Plus how much smell is dependent on what print mode is selected (how much curing time; printing speed, number of passes, ink limit settings, etc).

Sepiax odor is mild compared with UV or solvent inks.

PR releases via HP repeat over and over that latex ink has no odor. But the intense furnace-like heating required to cure latex ink results in the substrates emitting odors that are worse than the ink smell. Many printshop owners, managers, and printer operators complain about the odor coming from latex ink printers.

Ink: Replacing old ink containers

With a solvent system you can simply add fresh ink right into the system container.

With a UV system, old ink can gel, so for printers made in 2000-2006, you should be cautious about an on-board system that keeps old ink in a container. When one batch of ink is finished you want to get rid of the entire container along with all residue of that ink. When you add fresh ink you want to add the new ink in its own fresh container.

Where the ink may tend to gel most is in the secondary ink reservoir, since this is closer to the heat from the UV lamps.

Today, in 2010, the UV ink chemistry is better, and the ink lines are better protected with Pal filters. So gelation (on most of the high end systems) is not as much an issue today.

Although most of the times UV inks comes in 1, 2 or 5 liter containers, some UV printers use collapsible bags that occupy less space than traditional bottles when disposed ("bags in a box"). The Oce Arizona flatbeds and the Gerber ion flatbeds use this type of ink container.

Printers made from the ground up for Sepiax ink are still being worked on. The first installations are retrofitted Mutoh, Mimaki, Roland, and Epson printers.

Ink Costs

Ink costs more per liter for UV-cured ink; much more than per liter for solvent.

But with solvent ink you waste huge amounts of ink by spitting and purging. Purging also wears out your printheads.

UV-cured ink has little or no solvents to dissipate, so more of what is jetted out the nozzles stays on your print as an ink film. So in theory, you jet less ink for a UV-curable system than you jet, purge, and spit for solvent ink.

So don't worry about the UV-ink cost per liter. What counts is the UV-ink cost per square meter compared with all the solvent ink that would be used for that same square meter, plus wasted with spitting and purging.

Don't, however, get the impression that UV-curable inks require no purging. Indeed some UV printers even spit. But they don't spit as much as a solvent ink printer would. Where you waste money with UV inks is because of expiration dates of white ink. Purging to clear nozzles also raises ink usage on UV-cured printers. Why is this not mentioned in trade magazine articles? Why is this cost not discussed in Success Stories?

UV ink is much more expensive than solvent ink, but the ink consumption is much greater in a solvent printer than in a UV printer.

Certain brands of printheads have a reputation that they need more purging or spitting to keep them functioning. The Seiko UV printheads are considered the most prone to this. But like everything else in life, each component has downsides and has benefits. Seiko printheads are used only in a few brands of UV printers, and these printers can produce attractive quality, so the purging aspect (if your printhead has this issue) simply comes with the territory.

Sepix ink may not be low-cost at the beginning but the cost of the ink will tend to drop as time goes on.

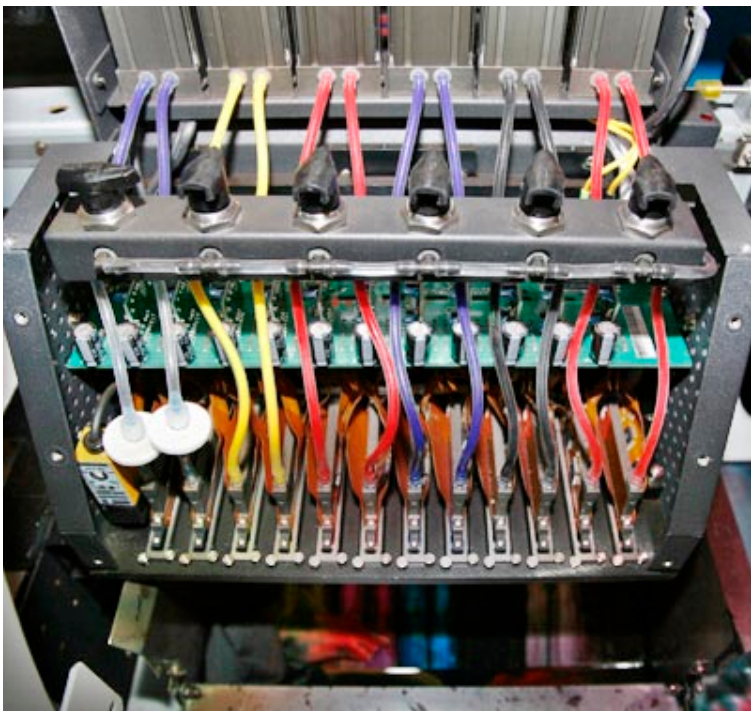
Ink cost impacted by the amount of ink required due to the solvent base

Solvent ink has the lowest cost which results in a good impression. But, since most of this ink is solvents, a substantial portion of the liquid is required to carry the pigments onto the substrate. So although the ink is cheaper than others, it takes more ink per square meter. So the cost per square-unit of printing is not as low as you would think. Plus a lot of ink is lost in the constant spitting and purging that is required.

UV ink requires about 40% less ink per square unit of usage because it sits on the surface and does not need to soak into the media. But, a lot of ink is wasted in purging and some UV printers also spit (at the end of a pass, or while in sleep mode). More UV ink is wasted in purging than the industry is willing to publish figures for. The amount of purging depends on which printhead is used. Some require more cleaning than others.

HP latex ink has no published specs on how it compares with solvent and UV ink usage per square unit (or if available, I do not have them).

Sepiax ink needs 30% to over 50% LESS ink per square unit of usage because it hardens and glues itself to the surface. The amount of purging is not yet known, and in any event depends on whether your printer started with Sepiax in the beginning, or whether you are using older Epson printheads and then switch to Sepiax by cleaning out the old ink. This may wear out the heads significantly.



Most solvent printheads need constant purging. This is a disadvantage because it makes you waste a considerable amounts of ink.

So you should not price your cost by how much one liter of ink costs but on how many square meters one liter of ink will print.

Ink Drying Times

No matter how many dryers and heaters you have on your solvent printer, the ink still requires many hours to be dry enough to laminate, for example. Although a solvent print may appear dry to the touch, it still may need several more hours of drying. The best admission of these problems is in the 3M bulletin, available on the Internet.

UV-cured ink is stated to be instantaneously dry. This is only half of the story. It is dry to the touch, but may not be totally cured. If not totally cured it can emit unpleasant odors for days or weeks. So we suggest you not immediately roll up or pack the printed materials. Give it some time to outgas (whether solvent or UV-cured).

How cured the ink film is also depends on whether the ink chemistry is free radical or cationic. To better understand the complex chemical differences, we recommend you attend the IMI Conferences on UV-curable inkjet technology. imi@imiconf.com, or telephone (207) 235-2225.

It is all to often stated by people in the industry that UV ink is instantly cured. This is not the truth; UV ink is instantly cured to a relative degree. The rest of the cure can take 24 hours to 72 hours… In other words, it may take a day, or longer, for UV ink to cure thoroughly. And, during these many hours the UV ink will outgas with a noticeable and objectionable odor.

Latex ink is the best drying of all since it is cured inside the printer at extremely high temperatures.

If you use Sepiax ink in a normal Roland, Mutoh, or Mimaki, the printed results should dry in about 24 hours. If you use Sepiax ink in a printer equipped with special hot air blower, the ink dries more quickly. Remember, Sepiax ink is new, and as soon as a dedicated "Sepiax Printer" is developed, then it's ink should dry the same as any other ink.

Does the ink cure inside the media, or on the surface?

Solvent ink needs to go inside the material and have the solvents evaporate (they turn into VOCs !). So solvent ink does not work well on any non-porous surface. Solvent ink works best on vinyl (PVC) because the heaters of the printer open the pores, the ink goes in the pores, more heat then evaporates the solvents and leaves the colored pigments.

Normal water-based inks generally go inside the media and thus require expensive ink receptor coatings to handle the amount of liquid water.

UV-cured ink is cured so fast that it turns solid on the surface. However on fabrics the ink would go through if the weave is open. Same with mesh. So you do need a mesh kit (a trough under the path of the printhead carriage, to catch the ink that goes through).

Sepiax resin ink tends to stay on the surface and not go into the material. The benefit is that you need considerably less ink (you do not need to fill the structure of the media with ink; you only need to cover the surface). Downside is for textiles you may want the ink to go further down.

If you need the ink to penetrate further into the fiber of the material, experiment with turning the temperature down a bit.

Clogging of the printheads with ink

Solvent printheads can clog easily because the ink can dry out. Solvent printers need purging, wiping, and capping systems to clean and protect the nozzle orifices. Many solvent printers even need to spit a droplet of ink every so often just to keep all the printheads unclogged. In winter you sometimes want the faucet to drip to keep the warm water flowing at least a little it.

UV printheads don't clog as easily because there is no solvent to evaporate. But, and here is what few people realize, some early UV inks actually contained solvents. Solvent-UV inks will tend to clog more than UV inks with fewer or none of this kind of solvents (I thank the IMI Europe 2005 lecturer for this information).

With or without solvents in the ink, the printheads in UV printers may clog a lot more than advertised.

Some of the better UV printers have UV lamps set at an angle. This is so that the reflection of their light will not reflect back onto the printhead nozzle plate and cure the ink on the nozzle plate or even up inside the nozzle. This reflection can happen either when printing a mirror, aluminum-like material, any other shiny or reflective material, or when the printhead carriage passes beyond the material with the shutters open; this may case the light to reflect off the top surface of the printer (especially from the flatbed table surface). Some flatbed table surfaces are very shiny.

Fibers from rugs and other fabrics can get entangled in the nozzle plate or stick up insize the nozzle cavety, and cause obstructions as well.

Clogging with Sepiax ink may depend on which Epson printheads you use, and whether they are new or used printheads. Realize that Sepiax ink today (in 2010) is improved over earlier versions of Sepiax ink in earlier years.

It would be a good test to learn whether Sepiax ink may clog less than Mutoh Bio-solvent ink (MuBIO)? We will all know more about this as Sepiax ink goes mainstream.

One leading giclee atelier in the US, who used exclusively Epson printers for years, finally gave up with Epson printers and switched to a thermal printhead. He said that he simply got tired of wasting time needing to constantly purge the Epson heads. The purging wasted ink and wore out the printhead.

So a need to purge is not necessarily the fault of any ink: it is an inherent aspect of Epson printhead.

What printheads work with which ink?

Latex ink presently works only with HP thermal printheads. But several companies in Asia are preparing latex-like ink that works with Epson printheads for Roland, etc. Obviously such a "latex ink" would be different from that used by HP.

UV-cured ink does not work well with thermal printheads (so this rules out HP and Canon). Epson printheads have not proven popular with UV-cured printer manufacturers either. UV inks work best with KonicaMinolta, Xaar, Spectra and Ricoh printheads. There is a separate FLAAR Report on printheads for UV-cured inks where we describe the entire list, such as Seiko printheads, etc.

Xaar, Spectra, KonicaMinolta, and Epson printheads are the main brands used by solvent ink.

For Sepiax ink, Epson DX4 and DX5 are the heads used for developing the ink. In theory water-based resin ink should also work with Konica Minolta and possibly with Ricoh printheads. Sepiax is water-based so will not work with most Xaar or Xaar-licensed technology. But Sepiax should work with certain specific Spectra printheads. I arranged a meeting with Howard Baldwin (Dimatix) and Sepiax ink at ISA to move forward on this aspect of seeing Sepiax ink also available for production and industrial applications.

Once Sepiax ink is formulated to work in Spectra printheads, it is a whole new world out there.

UV ink, if cured by LED lamps, has more issues than admitted

LED lamps are characterized by emitting considerably less heat than the traditional mercury-arc UV lamps. This means you can print on heat-sensitive media.

At ISA 2010, when asked about LED technology, one of the sales managers at Oce, explained this technology is still too expensive to be implemented considering the narrow range of media printable (curable) with UV LED lamps.

In the Fenix booth, the Mimaki JFX-1631 had unsightly splatter pattern, especially visible in areas of dark blue and black. At first I thought perhaps it was a bad photograph, but I subsequently learned that it was because they had run out of good boards and were using a foamcore with a surface that absorbed the ink. The LED lamps could not cure the ink fast or fully enough, so some ink was soaking down inside the material. The result was definitely not POP quality.

On all Mimaki UV printers with LED lamps; one or two materials are always still tacky when they attempt to cure with LED. The lame excuse is that the 3M ink has latex in it! Sorry, but I am not yet convinced.

Besides, you don't need LED lamps or nuclear reactor or nasty mercury-filled lamps to cure water-based resin inks, such as Sepiax.

Rate of change of the ink chemistry

Solvent ink printers is a mature technology with little innovation. Eco-solvent is a new chemistry and still has room for improvement.

UV printers is a new technology with changes and improvements in chemistry every few months. The ink formulas for some UV inks change every 18 months. In most cases the changes provide better features.

Not much change would be expected in latex ink since only HP offers it at present. It is not expected that any other manufacturer will attempt to create a printer that needs such extreme heat. Besides, Sepiax ink and Jetbest ink do not need much more than 50 degrees C. HP needs 80 to 100 degrees C !

Issues with static charge

Mimaki for years had problems with static charges causing the UV ink particles to be attracted to different parts of the substrate. The result was ink splatter everywhere (the image was ruined).

You would need to check about static situation with other inks, but I have not yet heard of static problems with inks other than UV, but you always need to ask.

Dust, a problem or not?

Solvent ink printers can probably print on and penetrate limited amounts of dust. So minor dust, though not ideal, is not a major problem.

UV ink, in distinction, needs a completely clean surface (no dust whatsoever, no oil either). This means that many kinds of materials must be cleaned by hand, sometimes dusted and then wiped down with alcohol, before printing. This adds to the labor cost.

Image Quality; banding

One kind of banding is caused by air getting in the piezo printheads. Another kind of banding is caused by inadequate media feeding mechanism. Banding is a perennial problem both with solvent and UV printers in that both use the same Xaar and Spectra heads. Epson printheads have even more issues with banding, especially the printhead models between 2001-2003. These are all piezo printhead technology. No thermal printheads are used with either solvent or UV inks. So if there is banding with Sepiax ink, it is as much the fault of the printhead as it is of the ink.

An additional cause of banding in UV printers is when they are operated bi-directionally (which is 99% of the time). The drops of ink on the backwards pass may land physically on top of the solidified drops of ink from the forwards pass, and create a ridge. This is because UV-cured ink does not soak into the material (especially not onto most rigid materials). The UV ink is flash-cured on top of the surface. You can run your fingers along the material and feel the presence of the UV ink.

Only a half-million dollar Durst Rho or a few other exceptional printers avoid bi-directional banding. But I would not expect bi-directional banding with latex or Sepiax inks.

But even in uni-directional printing, some of the cheaper printers still leave horizontal banding lines.

Intelligent Interweaving to cure feeding-banding was first promoted by Mutoh. Gradually some UV manufacturers are adding a comparable feature, using different names.

With other inks, there may be defects if the heat is not totally and absolutely even. If there is an air conditioning duct blowing cold air down on the right half of a Sepiax printer, that may cause differential curing than from the left half of that printer. But all you have to do is re-direct your air-conditioning duct, or re-position your printer. And, once printers are designed from the ground up specifically for Sepiax ink, this situation will improve.

Banding or other imperfections on solid black

If the printer you are considering has a potential banding issue, you will see it most clearly in an area of solid black color. This is true of both solvent and especially UV-cured images that are solid black ink (or most areas of dark colors).

Glossy finish

Solvent ink can produce a matte, satin, or glossy surface easily. UV can produce matte; glossy is hard to produce with some brands of UV ink (in 2004 initially available only on Sericol Inca Spyder 150). But this is changing. More and more UV printers are now offering options for producing at least a satin appearance.

With solvent ink the good ink matches the surface finish of the material: looks glossy on glossy material; will print matte on matte material. With UV ink, most prints tend to look matte.

HP latex ink has a reputation for being somewhat matte. Compare the output of the HP l atex ink and the gorgeous saturated colors and bright impact colors of the Seiko ColorPainter. The results from the Seiko printer look much more dramatic.

I have not yet noticed any issue with Sepiax being too matte. Frankly I was so impressed with the diverse range of materials that it was printing on that I did not worry too much about glossiness vs matte aspects.

Gloss Differential

A few brands of UV ink have severe gloss differential; dark colors have a different gloss than adjacent areas of less intense color. Sericol ink on the Oce Arizona is where you notice this issue the most.

I have noticed gloss differential with Jetbest (alcohol-based ink) as well. But that ink formula is very new and should improve as the chemistry is updated.

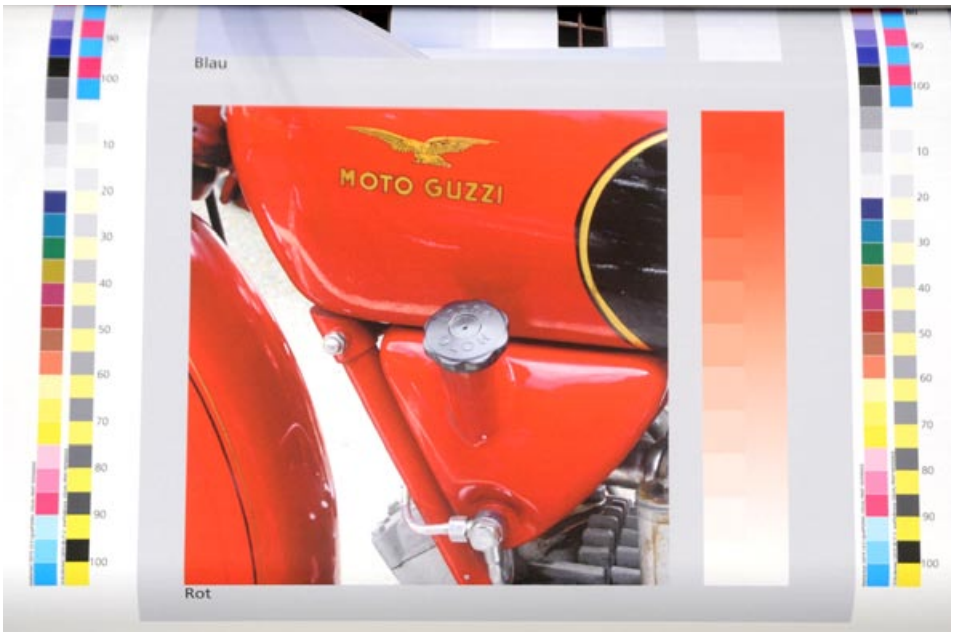
At VISCOM Milano there were serious issues with reflections off the black ink that were totally different than the reflections off the colors in the same image. The results were awful. So whatever ink you are looking at, be sure to test for gloss differential issues.

Overall appearance of the image

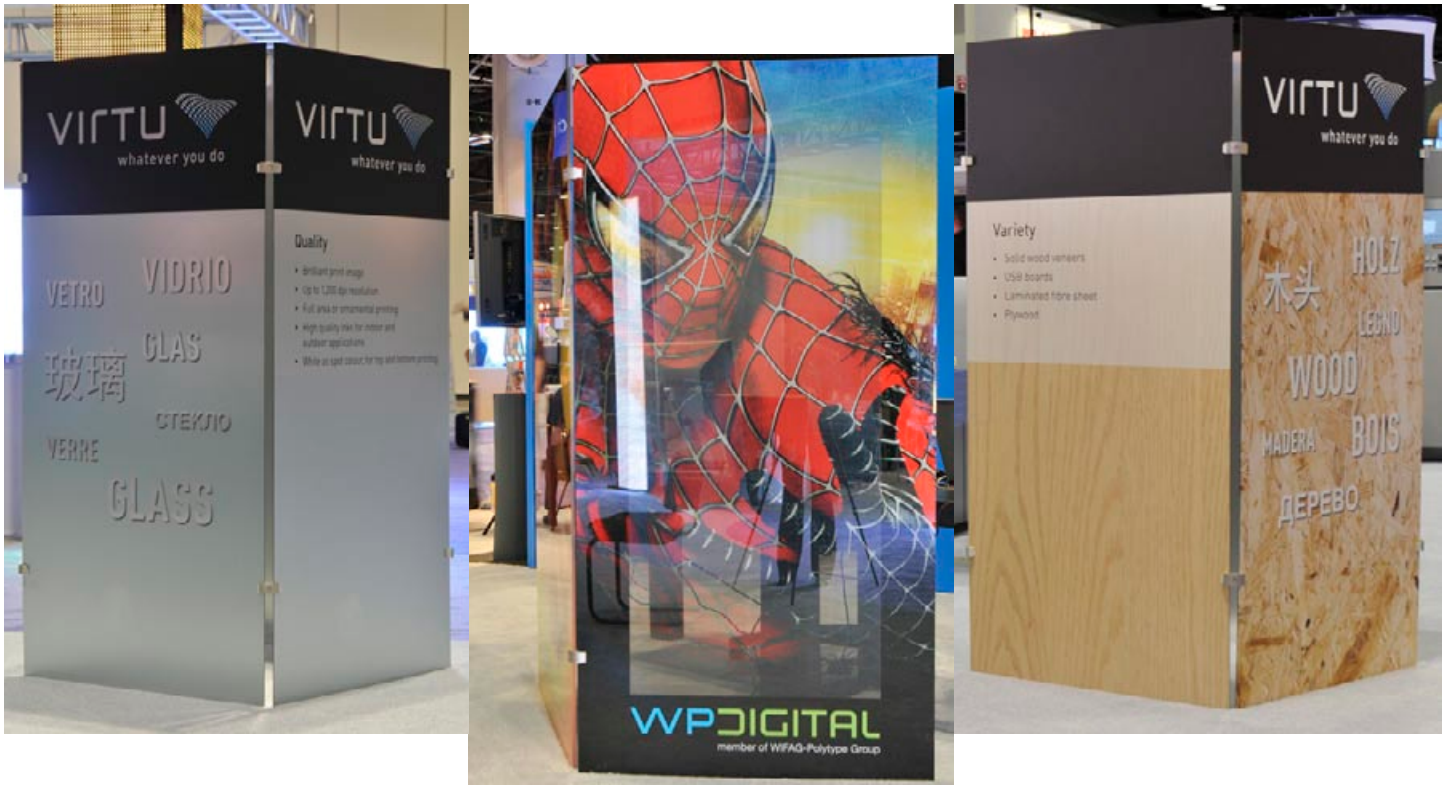
Several years ago, the output from both solvent ink and UV ink tended to have a splotchy appearance when viewed close up. But at a normal viewing distance you don't notice this condition and the images look quite nice (if you have the highest quality printer).

Today the quality of output from UV printers is gorgeous, though you may see the slight grainy appearance in some print modes.

New inks that require heaters need even heating or the output may be splotchy.



Print sample of the WP Digital Virtu RR50. Notice that the gray is nice and neutral color.



Print samples of the WP Digital booth at ISA 2010 trade show. When comparing the quality produced by different printers, it would be advisable to also check the production speeds, especially because at trade shows, companies tend to print very slow to achieve very high quality. The downside of this is that printing that slow in the real world is not realistic in terms of times/costs.

Images from FLAAR photo archive printed on with the Durst Rho 800 UV combo printer in Lienz, Austria.

Cracking if flexed

Full strength solvent ink effectively bonds with raw vinyl, so you can flex the vinyl and the image does not crack.

HP latex ink is claimed to be 200% flexible.

With UV cure the ink is a hard film on the surface, not inside the substrate.

So when the material under the UV ink flexes, the ink film will tend to crack. This is a crucial factor for vehicle wrap, especially over rivets and around fenders. Most UV ink is not good for vehicle wrap. But some UV printers have an option for allowing use of a special flexible ink, such as flexible ink from 3M or Sun.

Now, in 2010, since 2009, there are so many options for different flavors of UV ink that you can get about any kind of UV ink that you need, including for vehicle wrap and other flexible needs.

People who buy or use flatbed UV printers still complain today that the ink cracks when they flex the material. This is because these people were never clearly told that there are three main kinds of UV ink:

- Rigid ink for dedicated flatbed printers: intended only for thick rigid material (no flexing intended)
- Roll-to-roll ink for dedicated roll-to-roll printers: intended only for flexible material (not for rigid material).
- Half-and-half ink, for combo or hybrid flatbed printers: intended to flex a bit but still also to adhere to rigid material. Like everything else in life, if you try to compromise you have a compromise on both sides.

So it is not that UV-cured ink is bad, it is that UV ink will only do what it is made to do. If you have an ink on a dedicated flatbed, it is made for rigid material, period. If you have a hybrid or combo with moving transport belt, they tend to use a half-rigid half-roll ink. So it is okay for everything but not perfect for anything.

Seemingly Sepiax ink has none of these issues. But clearly there are a lot of tests to undertake to document the remarkable ability of a resin ink.

Sepiax ink container, B&P booth at Sign UK 2010 tradeshow

Material needs to be flat

Solvent ink can print okay on uneven substances, within reason.

UV printer mechanics work best on substances that are absolutely flat. UV printers can, sometimes, decorate recessed surfaces but don't handle bumps, splinters, or anything sticking up that could bump into the delicate printhead.

Fingerprints on the surface of a material can cause a blemish with any kind of ink.

Electricity costs

Solvent printers cause large electrical bills to handle the heaters.

UV printers result in large electrical bills to handle the UV-curing lamps.

I would estimate that the monthly electrical bills for a latex printer would be surprisingly high.

Sepiax printers would have an electrical expense about the same as mild-solvent when printing on absorbent materials. When printing on thick rigid materials the electrical usage would be higher.

Sample of how much electricity an over-sized UV flatbed required: Luscher JetPrint electrical unit, at site-visit case study near the FLAAR office in St Louis, Missouri.

Need for training

Both solvent and UV printers require at least some training to get you started. But since most UV printers are more expensive than a solvent printer of corresponding size, it may help to be sure that your UV printer operator has comprehensive training (and is of the appropriate personality to handle both the training and the printer).

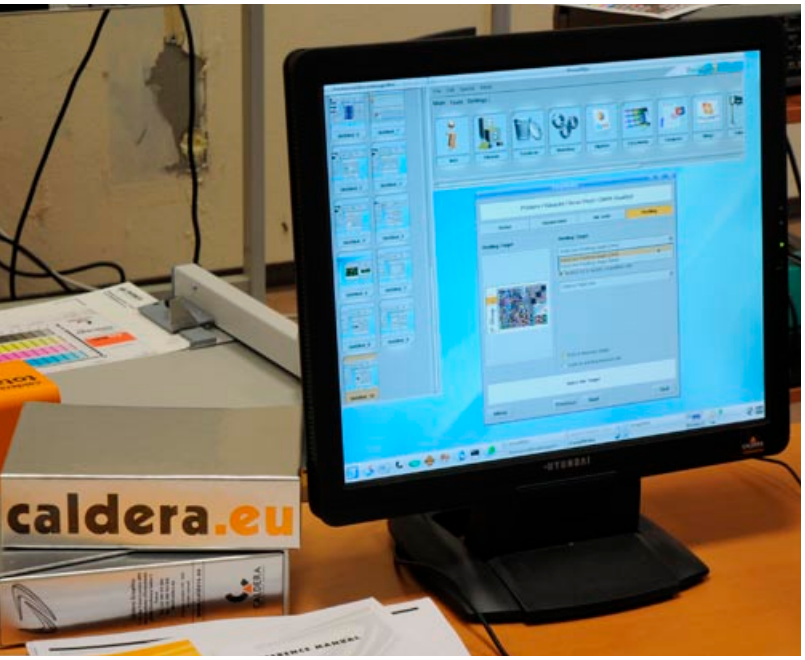
Sepiax printing should not require much special training !

I have been told that "latex ink requires patience and experience to profile new substrates." RIPs have had a tough time making their RIP software work with latex ink as well. However HP has done remarkably well in doing the best they can to make this unusual latex ink function adequately under optimal conditions. So latex ink printers do well in 'scripted' situations, but are iffy in situations or with substrates that are not predetermined.

RIP software

RIP software is about the same for both UV and solvent except if you are using white ink. Then you need to be sure your software can handle the sequence of laying down the white ink. The brand of RIP software that we know the best is from Caldera. But several other brands of RIP software work with grand format UV printers.

One major RIP company told me that they had to do quite a lot of tweaking to their RIP to get it to work on the HP latex ink printers. I found this situation intriguing. Why are the colors or curing of this ink requiring so much modification to a RIP software?



Caldera RIP software at factory visit 2008.

Heaters

Solvent printers need heaters, pre-heat, platen heat, and post-heat.

Most UV printers need to heat the ink to allow it to flow through the printheads. The only UV printer that I am aware of that needs heaters to handle the ink on the media is the new Mimaki UJV-160, which uses a flexible 3M ink and LED curing lamps. However the Roland LEC uv-curing printer may also need heat (it also uses LED curing).

Sepiax ink works best with platen heater underneath and hot air blowing down from above. The ideal printer (of those already made for other inks) is the Mutoh ValueJet hybrid; this particular Mutoh ValueJet is different than non-flatbed versions. The hybrid MuBio version has a hot air duct connected to the carriage.

But, you can also take any Epson water-based printer, or the Mutoh DrafStation (which is, in effect, same as an Epson 7800) and simply put in a heat strip on the platen (best to replace the platen with special heater and a tad more vacuum). Retro-fit kits will be available for many printers that have Epson printheads.

HP latex ink needs a veritable furnace to cure the ink. Up to 100 degrees C. Sepiax ink is content with 45 to 60 degrees C. Porous substrates may be content with the 45 degree range.

Vehicle wrap

A unique heat issue would be heat guns, used for lamination. What effect would a hot air gun have on latex ink (if it were not laminated). Would the heat re-energize the latex? Would the material shrivel? Need to ask this same question of each ink.

New UV ink formulas make it possible to print on difficult flexible materials like vehicle wraps, here in the GRAPO UV printer factory.

The ink of the Matan Barak5 UV printer is formulated to print on roll-fed media but it also handles rigid media.

Spitting

Solvent printers really ought to have a spitting system at the end of each pass (to keep the nozzles and ink lines of all colors open and with the ink moving even if the image itself does not call for all colors to be printing on every pass. If one particular color does not print on several passes in a row (such as a magenta text on white background; the yellow and cyan may not be printing), the yellow and cyan printheads may clog as the solvents dry from lack of use.

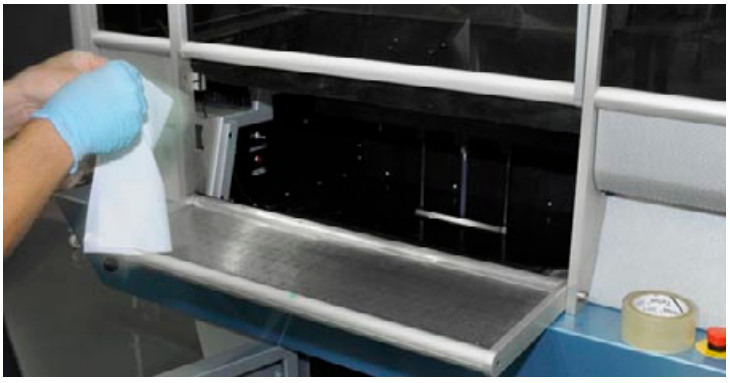
There are not enough descriptions of the printing process of UV printers to know if all colors have to be constantly jetted. But some UV printers do indeed spit: the Raster Graphics printer spits regularly, as do other brands.

Other aspects of maintenance

Solvent ink printers work best when they run all day every day. If you turn off a solvent printer you have to cap the printheads.

UV printers work best if operated all day long and every day all month (if the printer is robust and made to take this amount of use). Cheaper UV printers need to be turned off to let them rest and have the heat wear off a bit.

Turning off a UV printer and getting it up and running again after a two week Christmas vacation can be more or less problematic than with a solvent ink printer, depending on the engineering sophistication of the printer. A well engineered printer is understandably easier to turn on and off than a cheap printer with low-bid components.



Corrosive inks

Solvent inks are rough on ink delivery system components. When Roland attempted to first use solvent inks in their previously water-based printers, many parts of the printer could not hold up to the solvents.

UV inks don't attack most materials inside the printer, unless the inks are cationic: cationic inks ionize some metals (found in printheads or in the connectors for ink tubing).

Ink longevity

Longevity for solvent ink on vinyl is relatively well known. 3M and Avery have their warranties. A few ink companies exaggerate but overall advertising appears okay.

Longevity for UV ink is not yet documented. In many cases the material on which you print will degrade quicker outside than the ink on its surface. Someone said that longevity of Roland UV inks is not very much.

Two different giclee ateliers, each of which had a different brand of UV printer, said that if UV ink could be developed to last more than three years, they could make millions of dollars by printing décor onto architectural materials for decoring houses and offices.

It is expected that longevity of Sepiax ink will be comparable to longevity of eco-solvent ink (but without the VOCs).

Operating unattended

A solvent ink printer could conceivably be left to run unattended overnight (though equally obviously this is not without some risk).

But it would not be a good idea to leave a UV printer running unattended even during the day shift. The heat of the UV curing lamps is very high and could cause problems if an accident occurs while no one is nearby to shut the printer down. I have received several reports of UV printers catching on fire when the shutters failed to close and the UV lamps failed to shut off automatically. Irrespective of potential danger, some printshop managers have told me that on rare occasions they do let their UV printers run unattended overnight.

Now that LED curing is becoming available, fire is less a problem.

Fortunately, most well built and professionally designed UV printers have shut-off systems in case they get over-heated.

The extreme temperatures inside an HP latex ink printer suggest that unattended operation overnight could be risky. Ask printshop operators who own such a printer.

Operating Sepiax printer overnight is something we need to ask about too

It is advisable that a UV printer be attended at all times by an operator. Here the Gandinnovations Jeti 3348 UV JetSpeed at FESPA Amsterdam '09.

Operator with GRAPO Shark printer at Sign, UK 2010 tradeshow.

VOCs

Solvent inks emit noxious fumes and VOCs that are seriously hazardous to the environment and your health. Eco-solvent is simply less hazardous; if you think this ink is ecologically beneficial, you are reacting precisely as the ad agencies are hoping for. You are also suffering serious delusion.

UV-curable printers have an odor but negligible VOCs. Health hazards are more subtle. UV light is probably not good for your eyes either.

Although UV inks are a lot less harmful than solvent inks, an exhaust system is always recommended to get rid of heat from UV lamps and mist from the inks. In this photo, the exhaust system of the HP Scitex flatbed 6050 being installed at FESPA Amsterdam '09.

Carcinogenic nature of Solvent inks

Most full-solvent inks have known carginogenic chemicals. Some of the lite or mild-solvent inks simply have fewer toxic chemicals than full solvent. Eco-solvent formulas have tried to eliminate as many of the nastiest chemicals as possible. The resulting downside is that most solvent inks that lack the worst chemicals require coated media or otherwise do not function as well as full solvent.

In theory, UV-curable inks are supposed to be relatively benign. But in reality a few UV inks included carcinogenic chemicals in past years as well as other chemicals that may cause changes in your genes (I thank a colleague for alerting me to this situation with at least two brands of UV ink circa 2008).

HP latex ink and Sepiax resin ink are not supposed to have known carcinogens. But in general, ink is not good for your health in one way or another.

Improvements in Technology are applied more often to UV printers than to solvent machines

The most rapid changes in technology are with printheads: MEMS, or with printhead arrays (especially page width arrays). But the new printheads tend to be used first with UV printers and only later with water-based or solvent ink.

The rate of change in solvent printer technology is limited; this was long ago a mature technology.

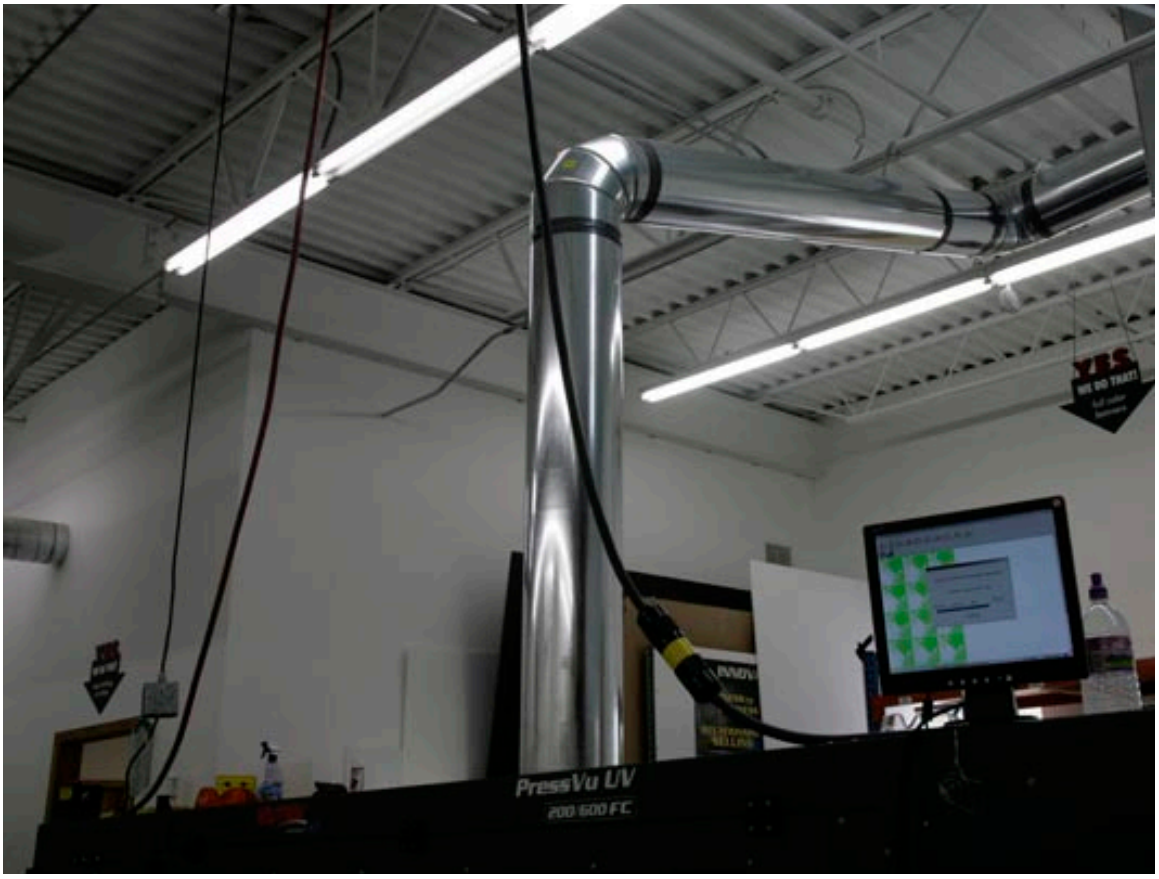
The rate of change in UV-cured printers is frequent. There are new inks, new curing methods, new ways to transport and load materials every several months

Since Sepiax is new, you can expect technology improvements here, both in printer hard ware and ink chemistry. With HP latex ink there is not been much different in the last two years. The lack of changes are in part because only one company is involved. The reason UV-cured ink has become so successful is because over 45 manufacturers have worked at developing UV-curing printers. There are already three companies I know who are developing printers for Sepiax, so that is lots more than are developing for HP latex ink.

WP Digital has developed an Internet (based) parts ordering system (IPOS). This is one of the innovations of this company. You can visit WP Digital at FESPA and ISA each year.

Exhaust Ventilation Systems

Exhaust system installed inside the facilities to avoid VOC and other hazardous elements from accumulating. Gandiinnovations site visit in Lisbon, Portugal.



Ventilation system for Vutek 200 at site visit

Productivity

Solvent ink printers are relatively productive since almost all are roll-to-roll. So your productivity per hour is the number of square meters or square feet that feed through the printer.

UV-curing printers in 5-meter widths are made for speed. So these are productive.

But most UV-curable inkjet printers are flatbeds. The productivity-per-unit of material figures are not realistic because you have to

- Hand clean, each sheet of material
- Or peel off a protective layer, by hand
- You have to lay the sheet down by hand, and align it.
- You have to off-load the material by hand (or have a $200,000 automatic loader/unloader)

Alignment, especially on entry-level machines is totally manual. If you are doing oneies-twosies then you have a lot of time aligning, setting the printer carriage height, and so on. Your productivity per hour will drop dramatically.

Sepiax printers run less fast than solvent printers. HP latex ink requires so much curing time and temperature on some materials that perhaps it is not the fastest ink of all.

As soon as a printer is made from the ground up for Sepiax ink, then its performance will be faster.

Productivity because of intelligent handling of flat materials

If you compare a solvent hybrid and a UV combo, the UV printers are significantly more productive. This is because companies have designed clever features to assist the printer operator to align and handle printing multiple boards simultaneously. VUTEk now has a new loading system for their UV-curing transport belt systems.

Durst also has a system (noted on their Rho 700) to help move large heavy rigid materials sideways on the feeding table as a aid to alignment. It will take time for these sophisticated printers to be available with Sepiax ink.

Roll-to-roll market share: UV vs. Latex vs. Solvent

It wil be much harder to sell 64" roll-to-roll UV printers at their high price now that a 60" latex ink printers are available for a lower price. And as soon as the 104" HP L65500 drops in price, then that will also make selling any 3.2 meter UV-curing roll-to-roll printer more difficult.

Although VUTEk may still be selling solvent grand format printers, they are not exhibiting them in their trade show booth in US and Western Europe since 2009.

If Sepiax ink becomes popular, it will take away market share from UV roll-to-roll and definitely gain market share against latex ink.

Misleading nature of advertisements

Most advertisements for eco-solvent printers in 2002-2003 varied from misleading to outright lies. The original inks were so inadequate that a new generation of ink was hurriedly prepared. The best documentation for the misleading nature of early advertising was the fact that Mimaki USA withdrew their first-generation eco-solvent printer because they felt that there would be a serious backlash by end-users once they found out how poorly it would perform. Other brands, and OEMs went ahead and issued their first-generation printers and there were serious problems, not just with the inks and substrates, but also with inadequacy of jerry-rigged heaters (remember, these printers were not originally manufactured to handle any kind of solvent ink)..

The ads for the new eco-solvent inks in 2004 and into 2005 still were occasionally misleading, sometimes potentially actionable (legally liable). The most misleading claims were that you did not need lamination. If this is so, then why do you need lamination even for pure solvent ink, such as on floor graphics?

The most noxious aspect of the ads for eco-solvent printers were claims that you did not need ventilation. The most clever misrepresentations of reality were insinuations that you did not need expensive coated material. When coated media was mentioned, it was suggested that this availability was an asset, not an expensive requirement.

UV inks had fewer problems, and advertising was not as misleading, albeit the issues of abrasion and adhesion were not adequately represented. Today the most misleading statements are made by a few individuals or PR releases that claim that UV ink can "print on anything." They don't admit that the ink will not adhere to the materials it prints on; or that the ink may abrade easily.

UV-curing printer adds should be more honest to list the number of materials that require priming. The fact that more and more manufacturers are adding an entire printhead for primer reveals how prevalent the need for priming is on many materials.

Many UV printer manufacturers do not face the reality of ventilation needed, and in general, health and safety issues are not admitted in the PR and advertising material handed out at trade show booths and in PR releases on the Internet. But overall, some ads for UV printers appear more honest and ethical than some ads for solvent printers.

Beginning in summer 2008, a new trend of misleading advertising is to claim that UV ink is eco-friendly. Prior to this date there was always a subtle undercurrent of insinuation that UV ink was significantly nicer than solvent ink, but suddenly two brands used the word eco to describe UV ink.

UV ink is simply another form of chemical. Breathing chemicals is not good for your health. Solvent ink ruins your health one way; eco-solvent ruins your health another way, and UV-cured ink simply is bad for you in some other manner. In fact the misting of UV ink in the ColorSpan 72uvX and cheap printers could be as bad if not worse than some aspects of solvent ink.

For Sepiax ink, one facet of advertising that I would be cautious with is overemphasis on speed. Roland is infamous for having slow Epson printheads but claiming "blazing speed." There are so many beneficial features of Sepiax ink that I prefer to concentrate on the actual pros and cons, and would not focus on claiming speed. When newer printers come out, that are optimized for Sepiax, then the speed will be faster. It would also be interesting to compare Sepiax speed with HP latex speed, since that is not very fast either.

I would also wait a while to claim there is no clogging with Sepiax ink. If you are utilizing Sepiax in old printers there is no way to control clogging since the printheads are already worn out even before you have to purge and flush all the earlier ink(s) out of the system. What is crucial is to learn about the rate of clogging of Sepiax ink in a printer designed from the ground up to use this ink.

Index of disallusionment

With full-solvent inks people should know what to expect. This ink has been around for decades.

With eco-solvent ink, the first two generations of its ink chemistry, had probably the highest percent of disenchanted end-users of any ink in recent history. Indeed the general manager of Mimaki USA refused to offer eco-solvent ink because "when end-users find out the truth about this ink, they will be very dissatisfied and it will be a terrible PR situation."

During the first two years we were inundated with complaints (not about our evaluations; we warned people; but about how much people feel they were cheated by advertising claims). The main factor was that this ink did require coated media that was really much more costly than substrates used by full solvent ink.

Now that the third and fourth generation of eco-solvent inks are out, you would need to be pretty naïve to expect more than you really get. Plus the printers are better and the inks are better. We find current eco-solvent ink since 2007-2008 as acceptable. The mild-solvent Roland printers and the Mimaki JV5 are probably the only two models within the last three years that have been inadequate in one aspect or other. But other Roland printers are good and other models of Mimaki printers are good.

UV ink has disillusioned a few printshops when clients refused to accept print jobs due to the odor that UV prints emit for days, weeks and potentially months. The other potential cause of disallusionment would be the curious color gamut of ink when it is UV cured. But you see this at trade shows so it's hardly a surprise when the printer lands in your print shop.

For bio-solvent ink, people were disillusioned before they even bought it. So the few that did buy it are probably content in most cases.

HP latex ink has a rising tide of significantly discontented end-users. Plus most analysts are disillusioned too (always off the record; none of them dare put this into words that they publish). But to be fair, I do know other end-users who are fully content with HP latex ink (but they are content because the limited range is what their clients need). If you, or you clients, need a more diverse range of materials, a specific color gamut, or color POP and rich blacks, you would be better off with a Seiko ColorPainter H74s or H104s.

This does not mean HP latex ink is bad, just that it was over-promoted, with too much emphasis on being a green solution (when it required an entire electrical power plant to generate enough power to run the unprecedented heat to cure the ink). But admittedly it cures the ink very nicely, on those materials that can take the heat.

Sepiax is too new to know any level of disillusionment. Need for printhead cleaning should not be a surprise to someone familiar with the requirements of an Epson printhead; they need to be purged frequently even with Epson's own water-based ink that is totally different than Sepiax resin ink. As for any printheads wearing out, this is also natural with an Epson head; piezo heads are not permanent (despite hype on this claim). And if the printer is already used, it's heads will react a bit differently than if you provide a virgin printer with virgin heads and Sepiax is it's first test of manhood.

To me the only aspect that could disappoint people is if they are hit with PR releases that promise super speed. This is why the FLAAR Reports mentions clearly that speed is not (yet) a bonus feature. Let us concentrate on what the ink does well and be realistic about speed. As soon as newer dedicated-from-the-ground-up printers come out, they should be a tad faster.

A comment on cationic UV ink

Presently only one company has been innovative enough to use cationic kind of UV-curing. Gerber offers cationic ink in three models of their Gerber ion flatbed printer.

Cationic ink has several advances over free radical cured UV ink that is used in 98% of the other UV printers. So several of the disadvantages list for UV inks are not a disadvantage with Gerber cationic ink.

To see cationic ink in action go to the Gerber booth at any major international signage printer trade show.

Should you wait to buy latex ink? Should you wait to buy Sepiax ink?

Probably half the people who bought HP latex ink in the last 18 months did so because it was the latest greatest and new thing around. They did not buy it based on what it could or could not do, but on the theory and chic aspect.

Some of them are content still; others are facing reality today realizing it was a premature purchase.

As soon as installations of Sepiax printers are available for inspection I will interview end-users to find out how the new inks are doing.

Summary

The general consensus from 2004 well into 2010 is that UV-cured ink is the technology of the future. Nonetheless, solvent printers will continue to sell well; eco-solvent has flourished now that the third-generation eco-solvent inks were not as flawed as the first two generations. Eco-solvent will be is surviving even in the face of competition from mild-solvent, full solvent and UV-cured ink. Bio-solvent made lots of noise in advertising and at trade shows, but has not yet been a big volume seller. Put as politely as possible, Bio-solvent inks is a passing fad and has not contributed any impressive ink (other than PR releases and good intentions). Latex ink (from HP, partially water-based), is too new to know whether it will really replace solvent ink, or not.

Overall, UV-curable ink printers will continue to make inroads. 2008 was an interesting year, first with FESPA Digital in Geneva, then DRUPA 2008, and then with post-DRUPA introductions at SGIA '08 and VISCOM Paris/Italy/Germany. ISA 2010 documented that UV-cured printers are still king, but at ISA 2010 clearly people in the know were beginning to think also about Sepiax ink. But there are still many new UV-curing machines being prepared for launch at FESPA 2010, SGIA or VISCOM in the autumn. But if resin inks turn out to be as utilitarian as we hope, I believe

While some UV printer manufacturers claim their machines can print on all rigid and roll-fed materials, at trade shows you will see most UV printers printing only on inkjet media specially tailored for inkjet printers. Or, if they print on glass, ceramic tile or metal, the printer manufacturers don't admit the ink will rub off quickly and easily. Only a few companies, WP Digital, Durst, VUTEk being some of several, have professional experience with the primers needed for glass. Each of these companies also has varying experience with the entire workflow for printing on glass.

It will be fascinating to see tests of how many materials can be printed with NO primer by Sepiax compared (tabulated) with materials printable by NO primer by HP latex ink, by eco-solvent inks, and even by UV inks. What happens if water-based resin inks can print on more materials than all these other inks combined ? Hmmm, sounds like what happened to 35mm film when digital cameras were invented. All of a sudden you did not really need film any more. I am a professional photographer, have shot for National Geographic (35mm and medium format) but I have not used my Leica or Hasselblad film cameras since 1996.

For most other kinds of inks, the substrates are coated to enable a higher print quality and ensure a better adhesion. When the ink drop is deposited on the substrate, the ink must adhere without running or smudging and spread uniformly in all directions. The inkjet media is expected to minimize problems such as bleeding, dot gain and clustering (mottle, see explanation in the area of Ink).

HP latex ink was definitely the most talked about ink at SGIA 2009, because this was the place where the 42" and 60" models were available in the USA. But I would not be surprised if Sepiax is the most discussed ink at FESPA 2010.

At ISA 2010 and Sign UK, there was plenty of discussion of HP latex ink, but mainly of what it can't do, and mainly of problems: thin media distorts due to extreme heat needed for curing, for example. The cause of the backtreading with HP latex ink is because too much PR resulted in too many of the wrong printshops buying latex ink. Once the printer was uncrated and put to real-world use, the printshop owners and managers learned what latex ink is incapable of doing. The owner of one of the larger printing companies in the East Coast of the USA said he was upset over the inadequacies of the 104" HP latex printer that be had purchased.

But every product is good for someone. What are issues in one application may not be pertinent to some clients if they are not using the iffy application or problematic media. So an HP latex printer can be a good solution if you, and your clients, know IN ADVANCE precisely what specific substrates you wish to handle. If you don't need other substrates and if yours can handle the heat, go for it.

UV-cured ink, especially cationic UV ink available via Gerber ion, is appropriate for many applications. UV flatbed printers will not go away (but when Sepiax ink comes out with Spectra or Konica Minolta print heads, this may replace roll to roll UV printers quickly).

Predictions

Mild-solvent ink is still popular. I have some end-users tell me specifically that they prefer the pop of colors and the deep rich blacks of Seiko ColorPainter over the matte appearance of latex ink.

The market share of eco-solvent has peaked and will gradually lose market share to resin inks. But eco-solvent ink will not disappear tomorrow. Thousands of printshops use eco-solvent ink every day and new variations of Roland's eco-solvent machines come out every trade show season.

So at FESPA 2010 we will still see all inks at this event. By SGIA in October rumors will be widespread about new or improved printers with Epson printheads and more rumors about Spectra printhead machines for Sepiax ink. By ISA 2010 or FESPA 2011 the new Spectra-printhead Sepiax machines should be out.

By FESPA 2012 (which I predict will be a more important expo than DRUPA with hotels near DRUPA ridiculously over-priced and the DRUPA trade show far too many days), at FESPA 2012 you will really see the new inks with significant market share at par with eco-solvent and what UV was like in its early years.

Nonetheless, the early-adapters are already switching to Sepiax ink. The switch in interest towards resin chemistry water-based inks has now begun. Month by month, year by year use will spread. Early adapters that can offer this ink to eco-conscious clients today in 2010 can gain market share. It would be great if some prototypes and beta machines can be sneak-previewed at VISCOM Germany and VISCOM Italy.

Just look at the rules for Wal-Mart. Suppliers have to track their carbon footprint: energy consumption (such as high electrical needs for heating an ink), emissions, etc. So if you want to win clients in your local area, now with Sepiax ink you have multiple advantages.

Acknowledgements

FLAAR began evaluating wide-format printers with the Encad NovaJet Pro 36, more than a decade ago. Today, in 2010, probably more than four million people have read our comments on wide-format printers over the last several years. About a third of this total has read our observations on solvent and UV-cured printers. But we are still learning about all the inks and technologies because there are new advances every year.

Our knowledge comes first and foremost from site-visit case studies to printshops. I thus thank the many patient printshop owners, managers and printer operators in Malta, Guatemala, Slovenia, Greece, Germany, Spain, Portugal, Canada, across the US, Korea, Taiwan who have opened their printshops to a visit. Naturally I appreciate the funding from printer manufacturers who have made these site-visits possible, as well as hosted my visits to the factories so I can learn about printers literally inside out. I do my best to visit as many factories as possible in order to be fair to each diverse kind of printer and ink technology, but even traveling an average of 300,000 km every year, there are still some brands I have not yet studied with as much detail as other brands.

I also thank the many industry analysts and knowledgeable people in inks, materials, engineers, and other aspects for them assisting me to learn about their fields.

I thank the several ink companies who have made it possible for me to be trained in their inks in R&D facilities around the world.

Bibliography

The complete bibliography on UV-curable ink printers is in the separate dedicated bibliography report.

There is not yet much of a bibliography on latex ink other than paid publicity or PR releases by people who have been feed PR releases. There are very few independent evaluations of latex ink.

Most recently updated May 2010 after seeing Sepiax ink in action at ISA and after Sign & Digital UK.

First issued as a comparison of solvent ink vs UV-cured ink: July 2004, after accumulating general information from several years of studying UV printers, aided by a concentrated dose of learning based on dedicating 10 days at DRUPA 2004 trade show in Germany to UV-curable inkjet printers. Updated September 2005 and again November 2005, February 2006, Sept. 2008, April 2009. First issued with comments on latex ink October 3, 2009. Updated with additional comments on HP latex ink March 2010 and based on more feedback from Sepiax ink at Graphics of the Americas and in based on 50 installations of Sepiax ink in South Africa.

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 that 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).

Licensing Information

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

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

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

Update Policy

Starting in 2008, updates on UV-curable wide-format inkjet printers are available for all individuals and companies which have a subscription, or to companies who are research project sponsors. If you are a Subscriber or manager in a company that is a research sponsor, you can obtain the next update by writing ReaderService@FLAAR.org. 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 workaround. And not all glitches manifest themselves in all situations, so our evaluator may not have been sufficiently affected that he or she made an issue of any particular situation. Yet such a glitch that we don't emphasize may turn out to be adverse for your different or special application needs.

Equally often, what at first might be blamed on a bad product, 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. If you received a FLAAR PDF from a sales rep, they may give you an early version; perhaps there is a later version that mentions a defect that we learned about later.

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

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

But even when we like a product and recommend it, we still can't guarantee or certify any make or model nor its profitability in use because we don't know the conditions under which a printer system might be utilized in someone else's facility. For ink and media, especially after-market third-party ink and media, it is essential that you test it first, under your conditions. We have no way to assure that

any ink or media will be acceptable for your specific needs in your specific print shop. As a result, products are described "as is" and without warranties as to performance or merchantability, or of fitness for a particular purpose. Any such statements in our reports or on our web sites or in discussions do not constitute warranties and shall not be relied on by the buyer in deciding whether to purchase and/or use products we discuss because of the diversity of conditions, materials and/or equipment under which these products may be used. Thus please recognize that no warranty of fitness or profitability for a particular purpose is offered.

It is also crucial to realize that an ink (that we inspect, that works well where we inspect it), your printer, your printhead, the heat, humidity and dust conditions in your printshop, may cause that ink to react differently in your printer. And, there are different batches of ink. Even in the really big multi-national billion-dollar ink companies, occasionally one batch will have issues. There are over 100 ink companies; six colors per company, many flavors of ink per company per color. We have no realistic manner of testing each ink. The same is true of media and substrates. One production run can have a glitch: chemical or physical, even in the best of companies. A major Swiss-owned media company, for example, had several months of media which were almost unusable. Yet other kinds of media from the same company are okay (though we stopped using that brand and stopped recommending them after all the issues we ourselves experienced).

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. Plus, there is no way to know if all MSDS sheets are honest to begin with! 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 make 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 unidirectional, which may be twice as slow as bi-directional.

Trade show examples tend to be on the absolutely best media. When you attempt to save money and use economy media you will quickly notice that you do not get anywhere near the same results as you saw in the manufacturer's trade show booth, or pictured in their glossy advertisement. Five years ago we noticed Epson was laminating prints to show glossy output because their pigmented inks could not print on actual glossy media. The same equipment, inks, media, and software may not work as well in your facility as we, or you, see it at a trade show. All the more reason to test before you buy; and keep testing before you make your final payment. Your ultimate protection is to use a gold American Express credit card so you can have leverage when you ask for your money back if the product fails.

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

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

Factors influencing output

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

Actually you may have people with even more experience than we do, since we deliberately use students to approximate newbies. FLAAR is devoted to assisting newcomers learn about digital imaging hard-

ware 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. Please be aware that our comments or evaluations on any after-market ink would need the end-user to use customized ICC profiles (and not merely generic profiles).

Be aware that some RIPs can only accept ICC color profiles: you quickly find out the hard way that you can't tweak these profiles nor generate new ones. So be sure to get a RIP which can handle all aspects of color management. Many RIPs come in different levels. You may buy one level and be disappointed that the RIP won't do everything. That's because those features you may be lacking are available only in the next level higher of that RIP, often at considerable extra cost. Same thing in the progression of Chevy through Pontiac to Cadillac, or the new Suburbans. A Chevy Suburban simply does not have all the bells and whistles of the Cadillac Escalade version of this SUV.

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

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

Just remember that every machine has quirks, even the ones we like. It is possible that the particular kind of images, resolution, inks, media, or other factors in your facility are sufficiently different than in ours that a printer which works just fine for us may be totally unsatisfactory for you and your clients. However it may be that the specific kind of printing you need to do may never occasion that shortcoming. Or, it may be that your printer was manufactured on a Monday and has defects that are atypical, show up more in the kind of media you use which we may not use as often or at all during our evaluations. Equally possibly a printer that was a disaster for someone else may work flawlessly for you and be a real money maker for your company.
So if we inspect a printer in a printshop (a site-visit case study), and that owner/operator is content with their printer and we mention this; don't expect that you will automatically get the same results in your own printshop.

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

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

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

The major causes of printer breakdown and failure is lack of maintenance, poor maintenance, spotty maintenance, or trying to jerry-rig some part of the printer. The equally common cause of printer breakdown is improper use, generally due from lack of training or experience. Another factor is whether you utilize your printer all day every day. Most solvent and UV printers work best if used frequently. If you are not going to use your printer for two or three days, you have to put flush into the system and prepare it for hibernation (even if for only four or five days). Then you have to flush the ink system all over again.

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

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

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

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

Yes, it is rather self-evident that we would never ask a manufacturer to send a product which we knew in advance from our studies was no

good. But there are a few other printers which are great but we simply do not have them in our facilities yet.

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

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

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

Availability of spare parts may be a significant issue

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

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

Lack of Tech Support Personnel is increasing

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

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

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

Counterfeit parts are a problem with many printers made in China

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

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

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

It is typical for some enthusiastic vendors to claim verbally that their printer can print on anything and everything. But once you unpack the printer and set it up, you find that it requires primer on some materials; on other materials it adheres for a few weeks but then falls off.
And on most hybrid and many combo printers, some heavy, thick, or smooth-surfaced materials skew badly. Since the claim that the printer will print on everything is usually verbal, it is tough to prove this aspect of misleading advertising to a jury.

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

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

Be sure to check all FLAAR resources

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

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

Acknowledgements

With 19 employees the funding has to come from somewhere, so we do welcome project sponsorship, research grants, contributions that facilitate our educational programs, scholarships for co-op interns

and graduate students, and comparable project-oriented funding from manufacturers. The benefit for the end-user is a principle called academic freedom, in this case,

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

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

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

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

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

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

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

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

We thank MacDermid ColorSpan (now part of HP), Hewlett-Packard, Parrot Digigraphic, Color DNA, Canon, Gandinnovations, and other companies for providing funding for technology training for the FLAAR staff and our colleagues at Bowling Green State University in past years and for funds to allow us to attend all major international trade shows, which are ideal locations for us to gather information. We thank Caldera, EskoArtwork, EFI Rastek, EFI and VUTEk, OTF (Obeikan), Drytac DigiFab, Barbieri electronic, Seiko II, Parrot Digigraphic, AT Inks, Sepiax inks, Sam-Ink, Dilli, Grapo, and WP Digital for providing funds so that we can make more of our publications free to end-users. During 2000-2001 we had grants to cover all the costs of our publications, and all FLAAR Reports were free in those early years. As that early grant naturally expired after a few years, we had to begin charging for some of our reports to cover costs. Now (in 2010), we are seeking corporate sponsorship so we can gradually make another 20% of our publications free to our readers.

Since 2006 we do a major part of our evaluations at a factory and headquarters demo room. Since the university does not fund any of these trips, it is traditional for the manufacturer to fund a research sponsorship. In the US this is how most university projects are initiated for decades now, and it is increasing. In fact there is a university in Austria that is not an "edu" but is a "GmbH", funded by the chamber of commerce of that part of Austria. In other words, a university as an educational institution, but functioning in the real world as an actual business. This is a sensible model, especially when FLAAR staff need to be on the road over a quarter of a million miles per year (roughly over 400,000 km per year total for the staff). Obviously this travel is hosted since unless money falls from heaven there most realistic way to obtain funding to get to the demo rooms for training is direct from the source.

It has been helpful when companies make it possible for us to fly to their headquarters so we can inspect their manufacturing facilities, demo rooms, and especially when the companies make their research, engineering and ink chemistry staff available for discussions. When I received my education at Harvard I was taught to have a desire to learn new things. This has guided my entire life and is what led me into wide-format digital imaging technology: it is constantly getting better and there is a lot to learn every month. Thus I actively seek access to improving my understanding of wide format printer technology so that we can better provide information to the approximately quarter-million+ readers of our solvent and UV printer web site (www.large-format printers.org) 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, EFI, EskoArtwork, Gerber, Grapo, IP&I, Mimaki USA, Mutoh, Obeikan, Dilli, Drytac, GCC, NUR, Oce, Shiraz (RIP), Sky AirShip, Sun, Teckwin, VUTEk, WP Digital, Xerox, Yuhan-Kimberly, Zund have each brought FLAAR staff to their headquarters and printer factories. AT Inks, Bordeaux, InkWin, Sepiax, Sam-Ink, and Sunflower ink have brought us to inspect their ink manufacturing facilities and demo rooms. Notice that we interact with a wide range of companies: it is more helpful to our readers when we interact with many different companies rather than just one.

We have visited the world headquarters and demo rooms of HP in Barcelona and received informative and helpful technology briefings

from HP about every two years. We are under NDA as to the subjects discussed but it is important that we be open where we have visited. Mimaki Europe has had FLAAR as their guest in Europe to introduce their flatbed UV printer, as have other UV-curable manufacturers, again, under NDA as to the details since often we are present at meetings where unreleased products are discussed. Xaar has hosted an informative visit to their world headquarters in the UK. You don't get this level of access from a trade magazine writer, and I can assure you, we are provided much more detailed information and documentation in our visits than would be provided to a magazine author or editor. Companies have learned that it's a lot better to let us know up front and in advance the issues and glitches with their printers, since they now know we will find out sooner or later on our own. They actually tell us they realize we will find out on our own anyway.

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

We thank 3P Inkjet Textiles and HP for providing inkjet textiles so we could learn about the different results on the various textiles. IJ 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 Hellmuth). The testing person for the HP ColorPro (desktop printer) said he frankly preferred his Epson printer. When we saw the rest results we did not include this Heweltt-Packard ColorPro printer on our list of recommended printers, but we love our HP DesignJet 5000ps so much we now have two of them, one at each university.

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

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

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

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

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

Grant funding, sponsorship, demonstration equipment, and training are supplied from all sides of the spectrum of printer equipment and software engineering companies. Thus, there is no incentive to favor one faction over another. We receive support from three manufacturers of thermal printheads (Canon, ColorSpan and HP) and also have multiple printers from three manufacturers of piezo printers (Epson, Seiko, Mutoh, and Mimaki). This is because piezo has definite advantage for some applications; thermal printheads have advantages

in different applications. Our reviews have universal appeal precisely because we feature all competing printhead technologies. Every printer, RIPs, inks, or media we have reviewed have good points in addition to weaknesses. Both X-Rite and competitor GretagMacbeth provided spectrophotometers. Again, when all sides assist this program there is no incentive to favor one by trashing the other. Printer manufacturer ad campaigns are their own worst enemy. If a printer did not make false and misleading claims, then we would have nothing to fill our reviews with refuting the utter nonsense that is foisted on the buying public.

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

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

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

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

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

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

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

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

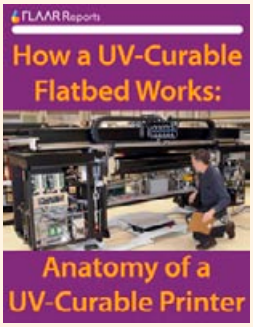
A modest portion of our income comes from our readers who purchase the FLAAR series. All income helps continue our tradition of independent evaluations and reviews of inkjet printers, RIPs, media, inks, cutters, laminators, and color management systems.

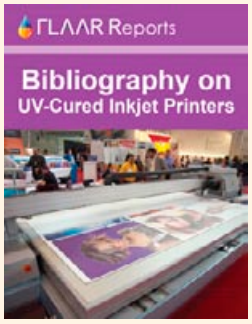
These are some of the most

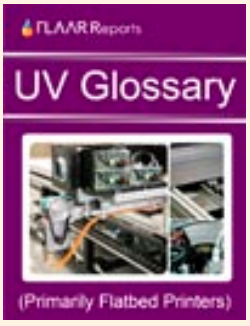
Recent FLAAR Reports (2008-2010)

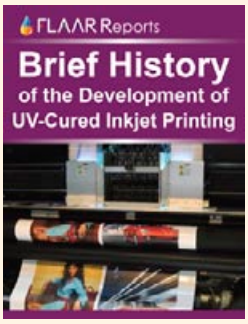
You can find these and more reports at: www.wide-format-printers.NET

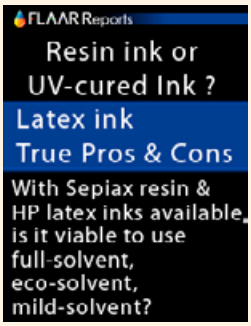
Introduction to UV Curable Inkjet Flatbed Printers

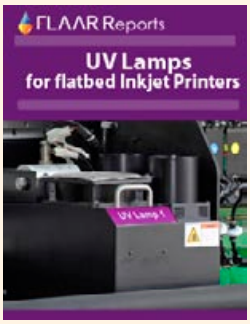


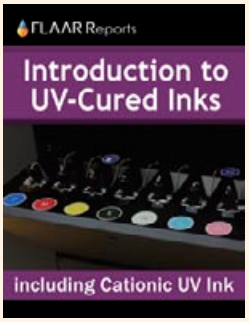












Most recent UV Printers

These are some of the most

Recent FLAAR Reports (2008-2010)

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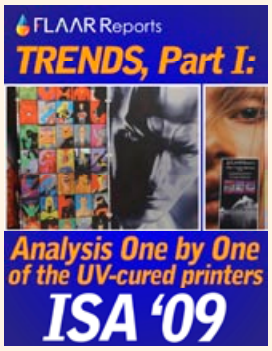
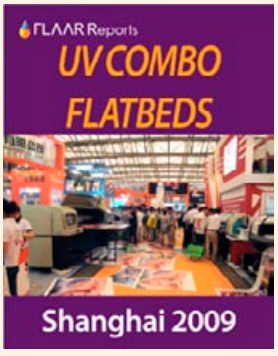
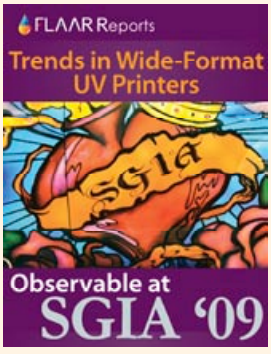
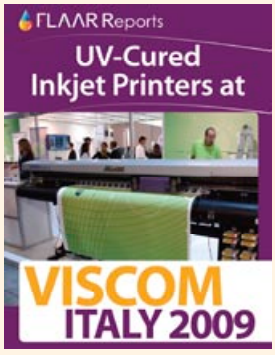
Comments on UV Inkjet Printers at Major Trade Shows 2007-2009









UV Printers Manufactured in China, Korea and Taiwan