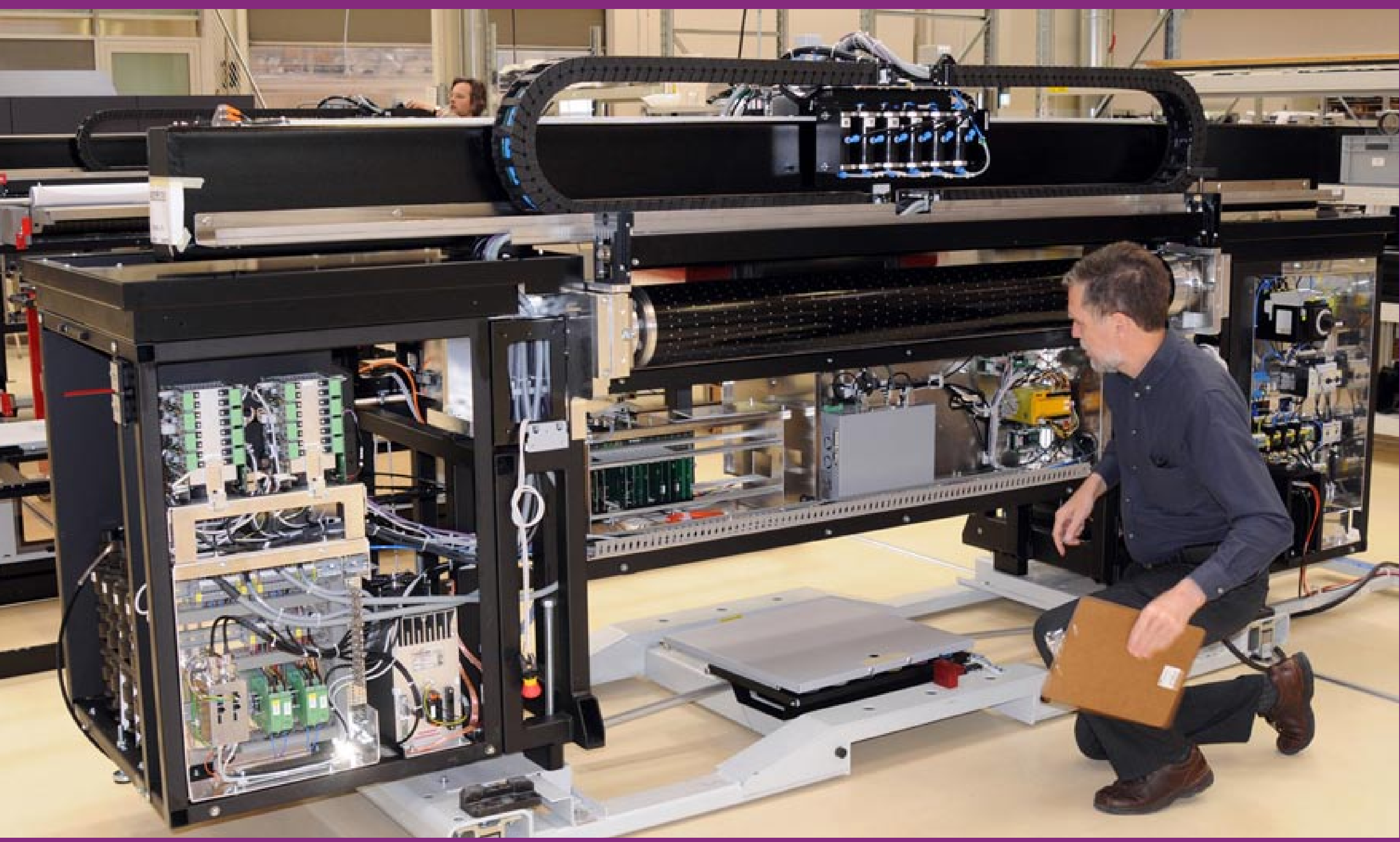
FLAAR Reports

Nicholas Hellmuth

October 2009

How a UV-Curable Inkjet Flatbed Works:



Anatomy of a UV-Curable Printer

Please Note

This particular edition of this special FLAAR Report has been licensed to WP Digital to distribute 200 copies of it during ISA, April 2009.

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 year.

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.large-format-printers.org, or otherwise directly from FLAAR. This is 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.

Contents

Anatomy of a UV-Curable Inkjet Printer

Introduction

If you thinking of purchasing a UV-curable inkjet printer, you might like to know what kind of technology is inside.

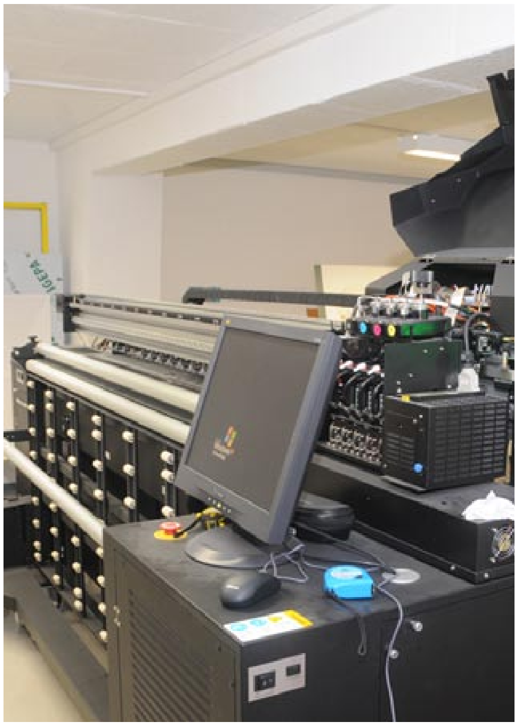
Screenprinters, offset press commercial printers, sign shops, and photo labs primarily want to produce images that satisfy their clients and thereby bring in a profit for everyone concerned. So the results of the printing are what count. It is rare that a print shop owner or manager has time to to learn what is going on inside the machine, other than the obvious need to know enough to properly operate the printer.

But all kinds of interesting technology are inside a UV-curable flatbed printer. It varies from what is probably the most complex machine ever constructed (Leggett & Platt Virtu, (now WP Digital Virtu RS35)) to the most basic: Oce Arizona 60UV ($40,000). This Oce printer was so basic that it failed to operate adequately and was withdrawn.

If you are seriously thinking of purchasing a UV-curable inkjet printer it is expected that you will visit trade shows and a manufacturer's or distributor's demo centers too. Before you make your actual purchase it is essential that you visit companies that have UV-curable inkjet printers at work. Try to find a situation that is not only a beta test site, since in some instances they have not had to pay for the printer; beta machines are sometimes provided by the manufacturer.

Some of these beta sites are, to some degree, extensions of the manufacturer's own demo centers. A few beta test sites are paid, either with free ink, free media, or free printers. Last year (May 2008), I read a Success Story on a flatbed that was so gushing in praise that it was embarrassing (and painfully transparent). This was a beta test site and the report was written by the manufacturer's PR team, not an independent observer.

You will find out the full truth if you search until you locate a print shop which has to pay for their printer the same way you will have to pay for yours: with income from the output. If the printer has flaws or if the output is unsellable, you will find this out only from an end-user. This is why FLAAR searches for appropriate locations for a site-visit case study. We do these printshop visits all around the world.



A good way to know whether a printer is adequate or not, is to visit a sign shop that bought the printer and whose personnel has first-hand experince with the machine on a daily basis. Here is a recent site-visit case study in a screen-printing and off-set printshop in Germany, to inspect a GCC StellarJET 183uv. By spending an entire day inside this printshop it was possible to gather enough documentation to update our report on this hybrid UV-curing flatbed printer.

Obviously during a live demo you can see the printer functioning and can ask questions of the tech support personnel. They can explain how the printer works better than we can, especially since there are more than 40 different makes and over 70 diverse models of UV printers and several different technologies as well as a variety of ink chemistries (free radical vs cationic) and methods of curing involved (LED vs mercury arc vs 60-inch long fluorescent-like cool-cure lamps).

So what this FLAAR Fast Facts intends to do is to assist you with some pointers about the basic technology of UV-curable inkjet printers so you will be better prepared to understand what questions to ask during a live demo. Hopefully you can ask better questions if you have a bit of background material as preparation beforehand.

Another way to know a UV printer is by visiting the factory and/or demo room. The main advantage of this is that you get to talk with people who know the printer inside out. At the left you see the WP Digital Virtu RR50 UV printer. At the right, WP Digital factory personnel.

I do not remember seeing any UV-curable inkjet printers until DRUPA 2000 trade show in Germany almost a decade ago (I missed the UV printer from Sias that was shown in 1999). In the beginning it took years to develop a final product: The daring manufacturers who first showed their prototypes at DRUPA 2000 or four months later at Photokina 2000, they did not have the printer fully out of experimental stage until a year or so later. Still today not many UV machines are as mature a product such as the HP DesignJet 5500 was for aqueous printers.

Yet at DRUPA 2004 a small company in the Czech Republic was able to show a UV-curable flatbed inkjet printer that they had built by themselves. They said they started learning about a Zund 215, were not totally satisfied, and so decided simply to construct one on their own.

This is the dedicated flatbed UV printer designed by the Czech company.

My PhD is not in inkjet printers and definitely not in UV-curable ink chemistry. We will need funding, and an illustrator, to show the anatomy of a UV-curable printer in graphic detail. But if GRAPO can construct one in just a few years, this reveals that the basic features are long ago known and in the public domain. FLAAR has a policy of not revealing any proprietary information, so our "anatomy" will be generic.

This report will develop gradually: the first phase is the present Fast Facts format will offer basic observations.

FLAAR is dedicated to research and public education, so everything here is part of our sphere of interest. The purpose of this effort is assist all those who are in the process of considering whether to purchase a UV-curable ink printer, as well as to provide general public education for students in graphic communications programs at community colleges and universities.

So let's look at a UV-curable printer from the point of view of what an end-user, who is thinking of buying this printer, needs to know.

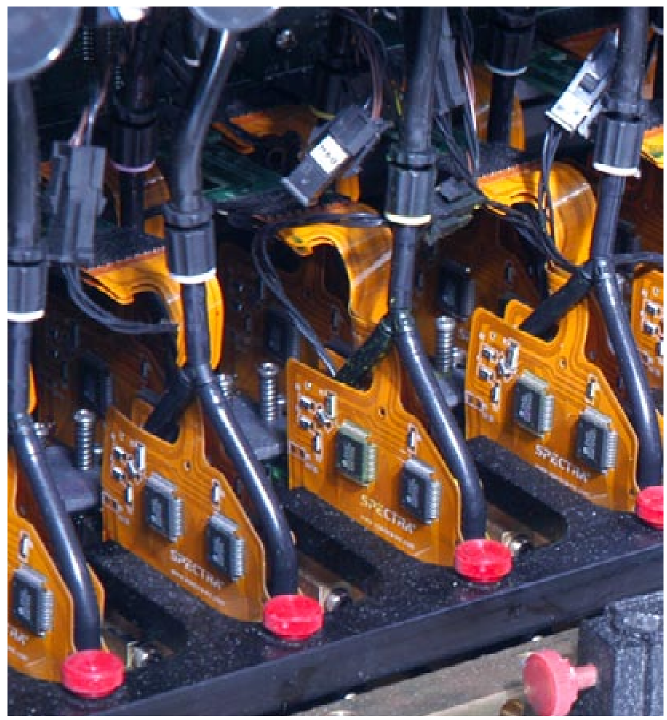
What features and factors to look for when making your Short List of brands and models to consider buying

Print quality is good, bad, excellent or iffy depending on several factors:

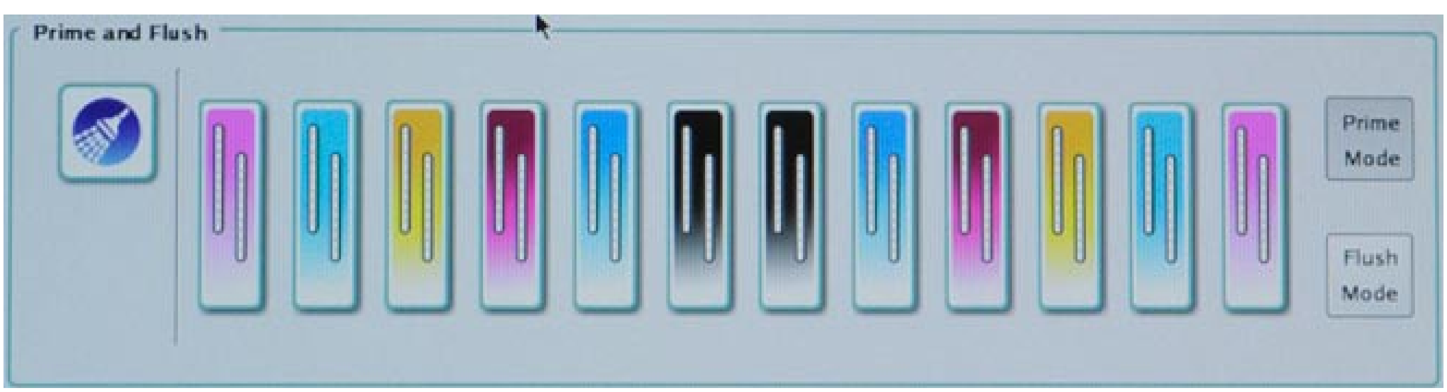
- Brand and model of printhead, which determines dpi and drop size
- Whether you have variable droplet or grayscale printheads
- Whether you have CMYK only, or six or eight colors
- The precision of your carriage system (the drive motor, for example)
- The chemistry of the ink
- The method of curing the ink: UV lamp, reflectors and cooling
- The precision of how the material is moved through the printer
- Software to handle bi-directional banding issues
- Position of the printheads
- Sequence of the colors
- Position and sequence of white ink options

What mode you select in your software obviously conditions quality: carriage speed, number of passes, whether bi-directional or uni-directional, etc. But simple things often get forgotten. One printshop bought a printer that was a literal nightmare from static problems. He had to retrofit his own anti-static system (in other words, he, on his own, had to jerry-rig a static prevention system). This is not something glossy advertising brochures warn you about.

The following FLAAR discussion of UV printers is intended as a general introduction. If you wish to go further, we have a FAQs with over 600 questions. But we estimate you would prefer to shorter version that we offer in this PDF that follows.



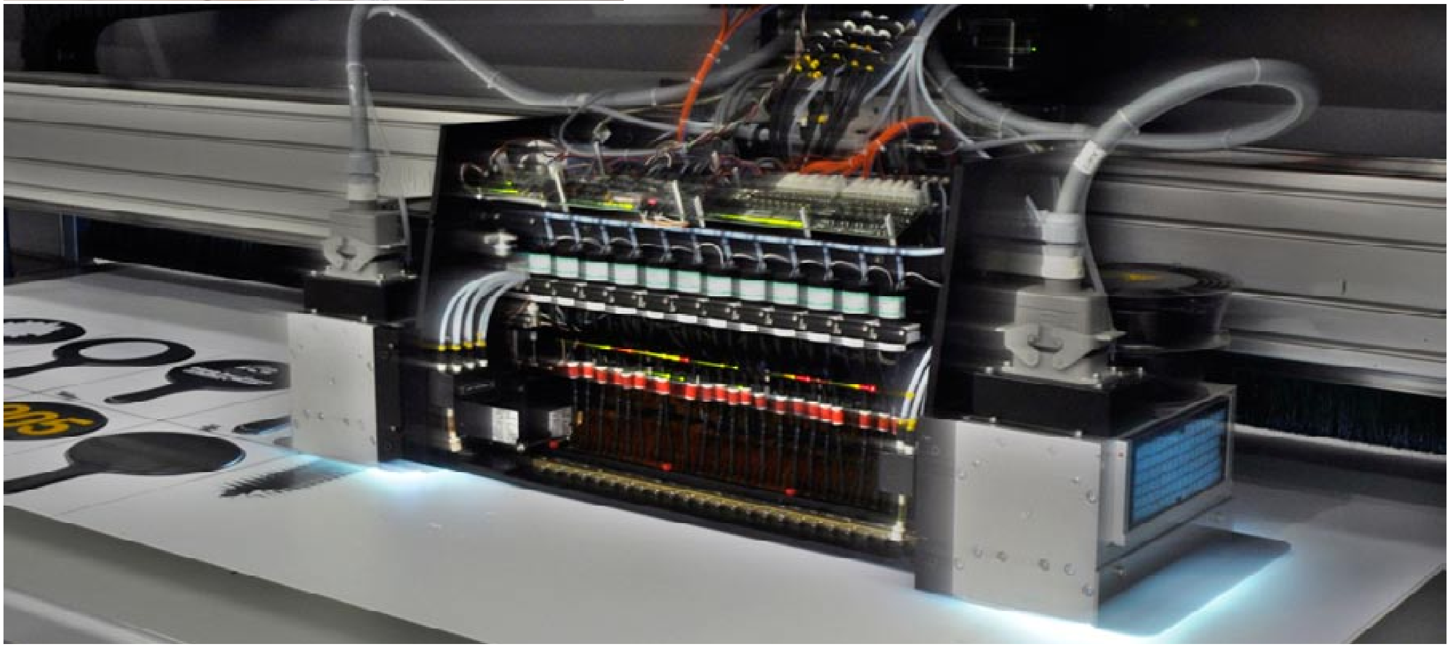
Brand and model of printhead determine the drop size of your printer. Achievable resolution will also vary from printhead to printhead.



This software display shows the color sequence of the printheads in a UV-curable dedicated flatbed printer. if you see the units from the center toward the left and right, you will see the printheads are mirrored.

The color gamut of your images will depend on the quantity of ink colors your UV printer features. Some printers offer CMYK, others offer CMYK + lc, lm (light cyan and light magenta) the sophisticated printers offer CMYK, lc, lm + White

Chemistry varies according to the company that manufactures the UV-curable inks. There are special inks only for rigid applications, there are inks for roll-fed applications, thermoformable ink, etc.



The precision of the movement of the printhead carriage is another factor that determines print quality. Carriage and feeding mechanism movements have to be synchronized to obtain an exact registration. Especially because the carriage of most printers moves at high speeds.

Print Quality

Satellite drops affect quality, especially the splatter seen on the edges of letters or where one color stops and another color begins. Although satellite drops and other common problems are a main cause of poor quality on regular inkjet printers, UV-inks splatter outside of their intended area for a variety of other reasons. One occasional cause of significant mis-directed ink splatter is when the substrate becomes charged with electricity through friction or whatever other reason. I witnessed a major ink mess with a Mimaki printer at NBM graphics and sign trade show in Indianapolis four years ago; but this reportedly happens only with some media. I have not seen this severe a problem mentioned at conferences (at least no illustration of the mess it leaves on the materials).

Banding was a bugaboo with early Zünd printers four years ago and most of the lower priced UV printers still today. Banding was caused both by mechanical issues (lack of precision) and seemingly by cheap printheads and inadequate firmware to control the printheads. But today most banding is caused by sloppy construction of the printer in the factory, cheap components, imprecise carriage rail, and antiquated stepper motors. If your printer does not offer a magnetic linear motor or at least a drive motor more advanced than a stepper motor, you should look for better quality engineering. Durst, Gandinnovations, L&P, Spuhl, and now WP Digital Virtu are examples of the more sophisticated kind of drive motors for their printhead carriages. The last printer, other than entry level, that may have used a stepper motor was allegedly a Japanese-made flatbed that was launched in late 2007.

As mentioned before, if the feeding movement and the printing movement are not synchronized, the print image will have problems such as banding.

Software, called firmware, is a crucial ingredient to create attractive print quality. True, if all you are printing is building wrap and billboards, then banding will not be noticed by viewers driving down the highway. At VISCOM Italy a few months ago (late 2008), I saw banding on the premier printer in the largest roll-to-roll UV printer booth at the show. The operator was actually surprised that I had bothered to ask why there was unsightly banding: he said, what do you expect, this printer is for billboards.

Yet why not consider a printer brand and model that can produce both: attractive results for close viewing as backlit, POP, and even décor. And then on other days you set the same printer to billboard mode and crank out material for distant viewing.

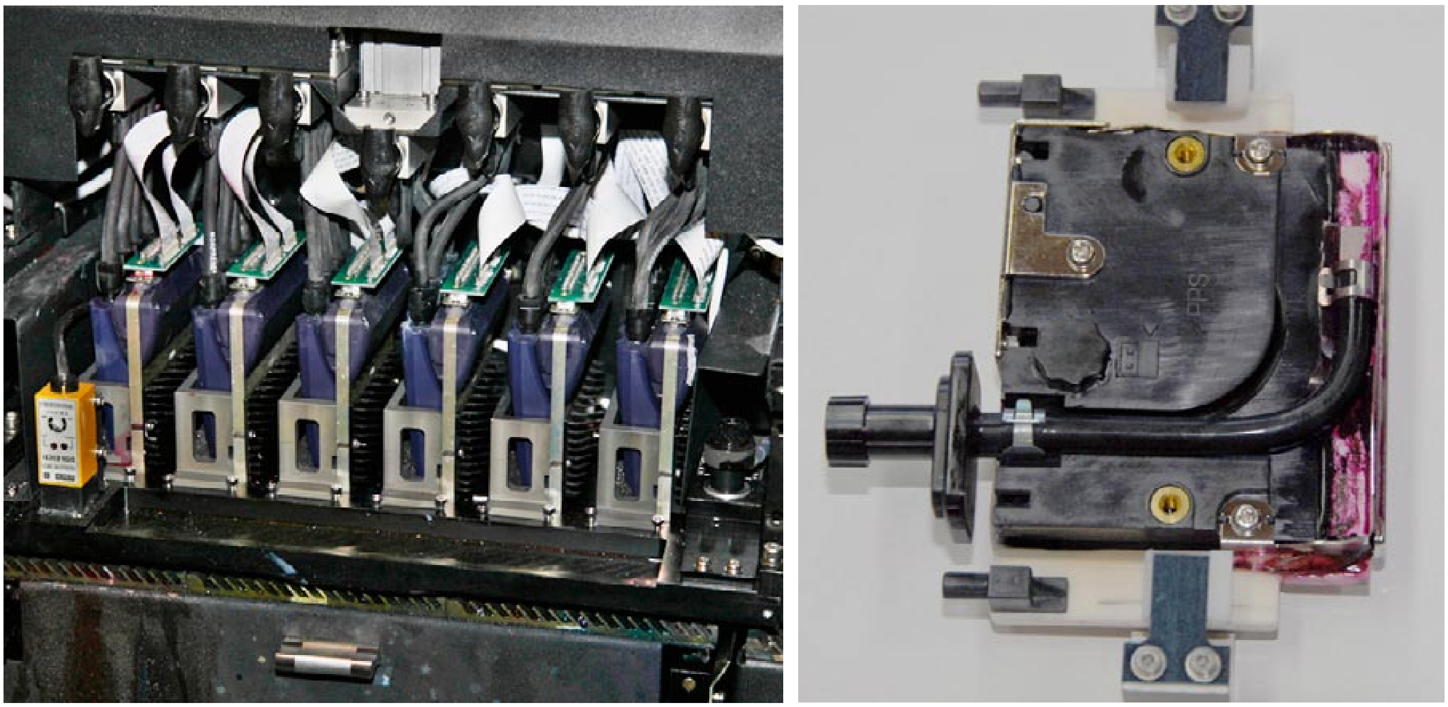
Caldera is the industrial-strength RIP that I know the best because I have spent several days being trained in their world headquarters in Strasbourg, France (last year). When I interview printshop owners and printer operators who know many different brands of printers and several good brands or RIP software, usually they complement the capabilities of Caldera RIP for UV and for solvent-based printers.

Some RIPs are great for traditional water-based printers. I learned from several days being trained on Shiraz RIP in their UK headquarters several years ago. But for a large UV-curing production machine, you should consider a RIP that is made specifically for grand format kind of printer.

Printheads as one factor of Print Quality

Splotchiness is a telltale mark of a printer with earlier brands and models of printheads, but splotchiness is not entirely the fault of the specific brand of heads. If a printer assembly is skimping on price by using a low priced printhead, they are also skimping on quality elsewhere. So the sum total is splotchiness.

But other factors also impact lack of output quality because when the same printer manufacturer switches from Xaar to Spectra heads, the output may still be splotchy looking (note that this was on UV printers between 2001-2006; output today from Xaar 760 and most Spectra heads is gorgeous). So an imprecise print quality is as much a result of UV-curable technology per se, since each ink drop may solidify on its own (in light-colored areas especially). So you get the grainy appearance, comparable to early Encad printers of 1997-2001 or most solvent ink printers until they started using Epson printheads.



Printheads from two different UV curable printers. At the left, the heads of a UV hybrid printer. At right, the head of a dedicated flatbed printer. The selected printhead is an important factor to print speed.

So this is your first clue of a good test for your demo: have a test print with many light tones. Printers with only CMYK claim that their grayscale heads can overcome lack of light Magenta and light Cyan. Best way to test that bluff is to take the same test print (of light gradients) to any printer with Toshiba Tec heads, and then the same to a printer with Spectra or other printheads that may not have grayscale technology, but which do offer six colors.

Have a test with adjacent colors to see how much overspray you get from droplets of one color marring the edge of the adjacent color.

Selection of the printhead brand does influence quality. But merely putting a good brand-name printhead in an otherwise low-bid printer is a waste of money. The entire carriage system and drive must be precise or your Japanese or European or American printhead is not much help.

Plus, if your material that is being printed on is skewing, stuttering, or skipping, having an expensive printhead is not much help either. In other words, every aspect of your printer must be precisen engineered. So far Swiss (WP Digital), Durst (both Italy and Austria), and Korea have the best reputation for pure precision. If a printer shakes so much that you can't read the LCD monitor because the monitor is shoved back and forth by starting and stopping of the carriange, that is not the precision I see on European or Korean printers. The machines made in Taiwan receive praise as well.

There are subtle differences between some printheads; dramatic differences among others. So a printhead is a crucial component in a UV printer. We recommend you get ahold of the IMI conference reports on UV-curable printers. Spectra (Dimatix) offers the best information on printheads so far, in the IMI conference proceedings by Baldwin.

So far all printheads currently being used are piezo technology. But Hudd reports that Canon has used an aqueous UV-curable ink with their thermal inkjet heads (2004:8).

Spectra, KonicaMinolta, Toshiba Tec and Xaar are the most frequently used printheads since 2007, with Spectra clearly being #1 in popularity for grand format UV-cured production printers.

Today (2009) many different companies in Japan are competing to build the next-generation inkjet printhead. Additional brands besides the four most popular are becoming better known. Quality is increasing for UV printers. Gradually even the dotty grainy appearance should be largely overcome. Page-array printhead systems are gradually being developed, but these printers cost over one million dollars. In general, printheads are the part of a UV printer that are improving the fastest. And once their price-per-nozzle drops, then the cost of the entire printer will also become more affordable.

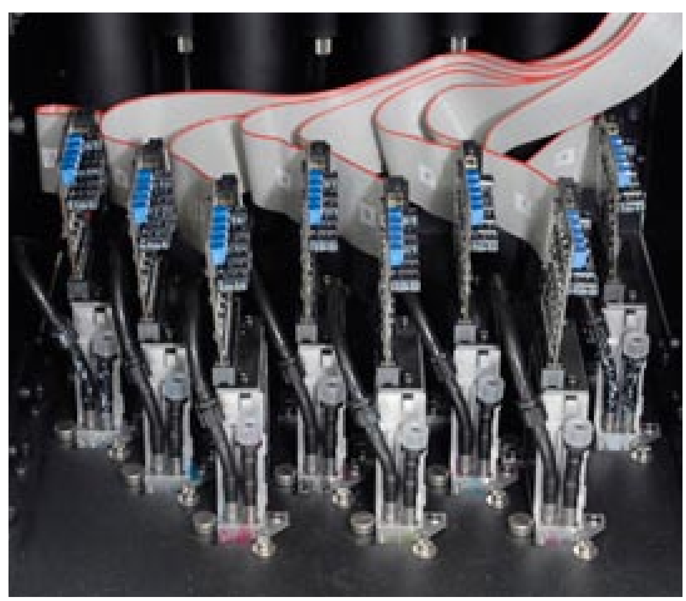
Dr. Nicholas Hellmuth inspecting the printheads used by a known wide-format UV printer.

If you are a print shop owner, manager, or operator, it definitely helps to know the pros and cons of the printheads that are inside the printer(s) on your short list. You do not need to know whether it is a side-shooter or top-shooter or shared-wall (leave that to the engineers). What you need to know is how robust they are, how often will they fail, how long does it take to replace them, how long the warranty is.

Learn how they should be cleaned, and more important, which leaning methods NOT to try. Some heads prefer purging; others prefer sucking. Mimaki tried to use mechanical wipers (which most all other manufacturers learned quickly was not always a good idea). Some economical printers actually use vacuum cleaners. Yes, you can look behind the printer in the booth at a trade show. That is not to keep the booth floor clean, that is to clean out the printhead nozzles.

It is especially helpful to learn about what other printshop owners say about these heads: how do they function out in the real world? Do they require more spitting, or more purging? Do they hold up to cleaning? Wiping? Sucking?

Every printhead has some excellent features. But not a surprise, every printhead may have a few issues or weak points. You do not have to avoid a printer just because its printhead has a glitch: the printer (and head) may have so many beneficial features that you will accept a few downsides.



Some printheads are aligned to each other. This UV printer uses the printheads a few centimeters offset relative to each other.

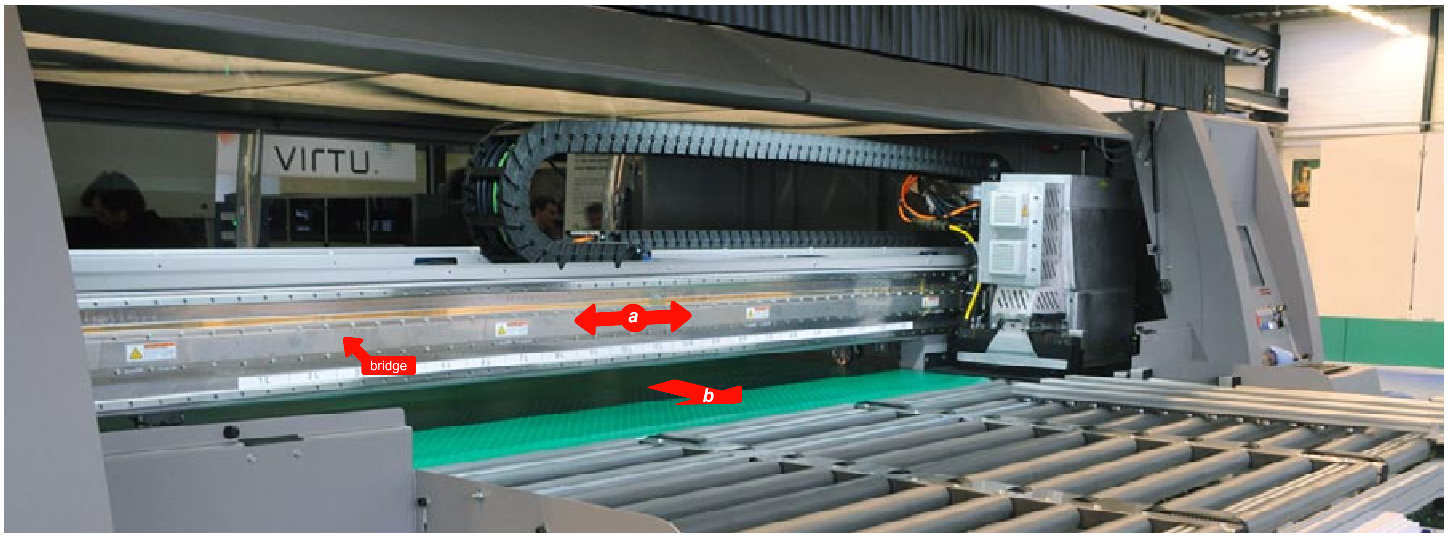
What part of the Printer System Moves?

When you visit a major trade show you may notice that the relationship between the positions of the printhead and the media vary. There is no one single technology of media-feed that has become de-facto standard. Each printer integrator has done their best to maximize the benefits of whatever feeding mechanism they have decided on. There is no one system which is perfect and no system (so far) which has enough serious downsides so as to suggest that you should always avoid it.

Holding stationary materials or transporting moving substrates impacts on image quality. In a regular solvent or aqueous printer the printheads go back and forth on the X axis. The media is transported incrementally by being pushed or pulled along the Y axis. Most of these printers have optional settings for bi-directional printing (faster) or uni-directional printing (tends to be higher quality, but slower).

UV-curable inkjet printers tend to use the same traditional movement of the printheads: Durst, WP Digital, IP&I, Grapo, GCC, EFI Rastek and most others move the media step by step in the Y axis as the printhead goes back and forth in the one X axis.

The Leggett & Platt Virtu is similar but it also has an optional feeding movement. This technology is now owned by WP Digital of Switzerland. Their Virtu RS25 and RS35 are unique in what moves and what does not move. Best if you see this in a demo (most printer manufacturers welcome you in their factory and/or in their demo rooms). They have a new demo room in New Jersey.

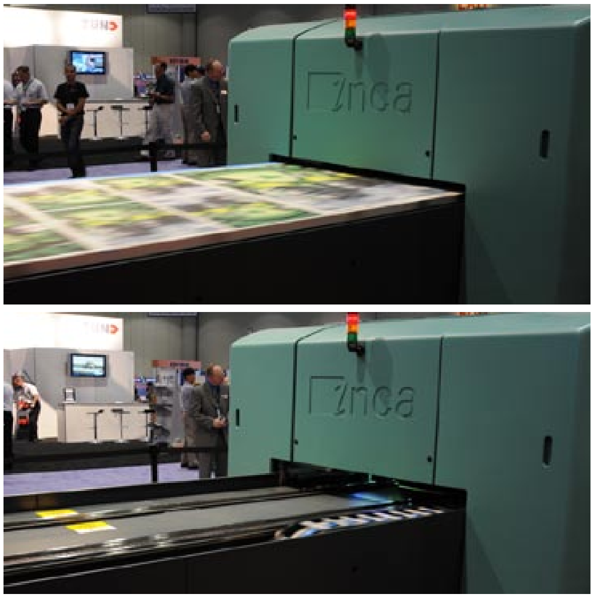


WP Digital Virtu RS35 UV printer. The printhead carriage moves in X-direction (a). If you print on Roll-Fed mode, the bridge is stationary. If you print on Rigid mode, the bridge will move to the far back and begin to move forwards (b) as the carriage travels from left to right.

When you go to any printer trade show you very quickly notice that at the Inca or Sericol booth their Inca Columbia Turbo is shooting the media back at forth at tremendous speeds. It is a marvel of engineering quality that they can achieve each line of printing in precisely the proper position considering the distance traveled and the speed. The Inca Eagle has the same system, just not as fast.

The Inca printhead assembly moves across the X axis, but the media is rapidly propelled back and forth, back and forth along the Y axis. This needs a Flash Animation or a sequential step by step drawing to show how the image is built up.

A third variant of flatbed has the media totally stationary and the print head moves across the X axis but the total printhead assembly is moved incrementally along the Y axis (so the printhead assembly is what moves, not the media). The reason is because you never know what kind of media you are trying to move, so feeding media with push, pull, or rollers is always subject to the surface friction of the particular kind of media. It does not take much for the media to skew, slip, or otherwise not move perfectly. When the media is stationary (as on the Virtu RS25 or RS35 in dedicated flatbed mode) you only have to control the movement of the printhead assembly.



In these type of UV printers, media is moved back and forth.

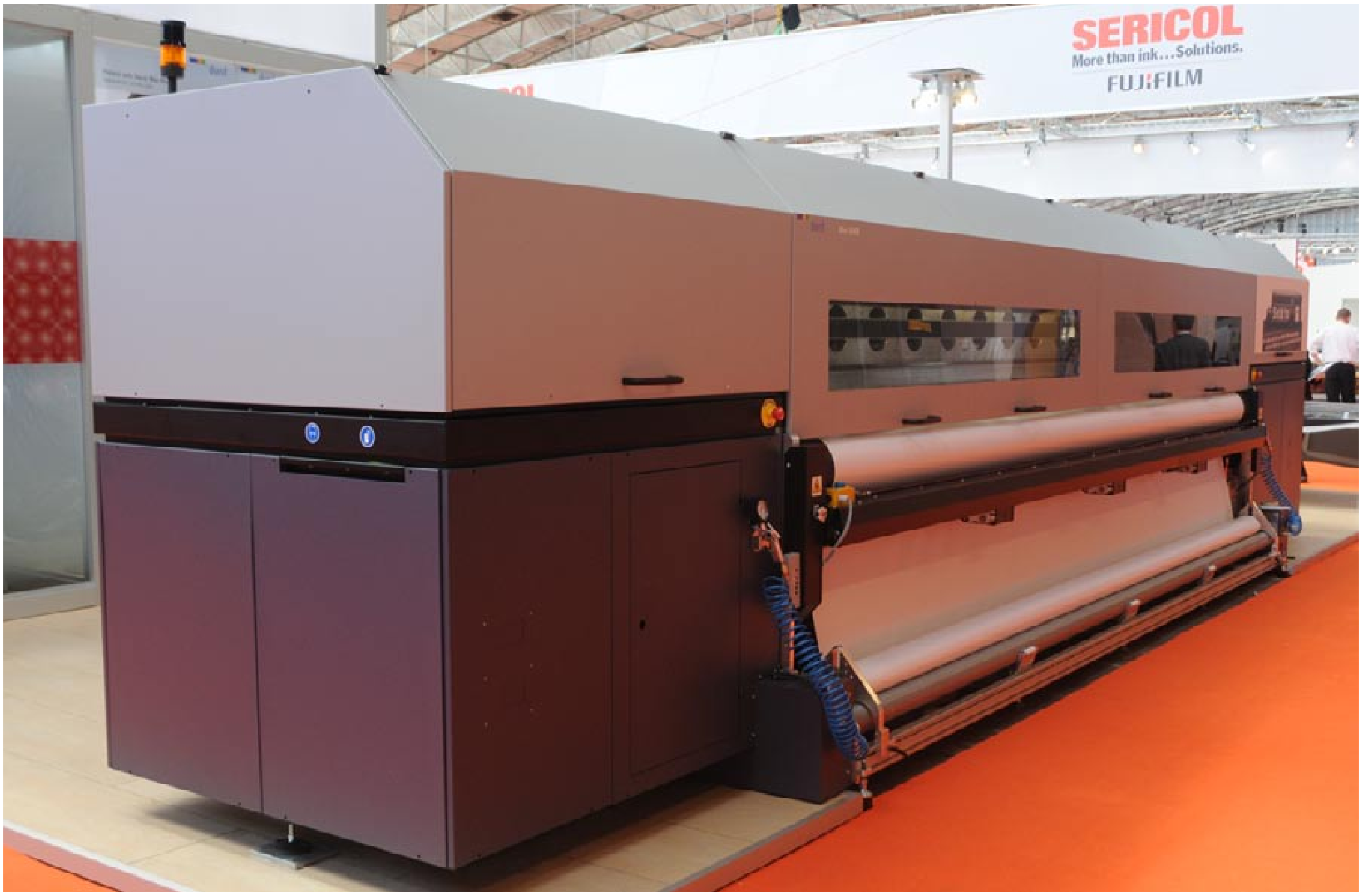
James Gill, a person within the industry who is knowledgeable in grand format solvent ink and UV-curable flatbed printers, has prepared a useful set of diagrams to show the three predominant mechanisms of how the media interacts with the printhead (2004: IMI conference Proceedings). If you go to a really large trade show such as FESPA, DRUPA (in Germany) or ISA or SGIA in the US, you can usually see most of the variations, but only one system offers a flatbed that either moves or can remain stationary (Virtu RS).

Suggested Classifications of UV-Cured Inkjet Printers

For the last several years there have been two FLAAR publications on UV-cured inkjet printer classification. So I defer to those two tomes for details, but for this "anatomy" discussion, we need to establish the jargon up front.

Please realize that there are no industry standards set by anyone else. "Hybrid" and "Combo" or "Combi" are used interchangeably. But my background as a university professor in my previous life suggested that it was necessary to establish order, so I define classifications of UV printers in a simple and straightforward manner:

Dedicated roll-to-roll: this classification is already widely used to describe the NUR Expedio, the Durst Rho 350R and 351R, the Gandinnovations Jeti 3324 UV RTR, Matan Barak, and the new WP Digital Virtu RR50.



The Durst Rho 500R is a dedicated roll-to-roll UV printer. This and other respected printers handle only roll-fed materials and don't try to improvise a table to attempt to print on rigid materials.

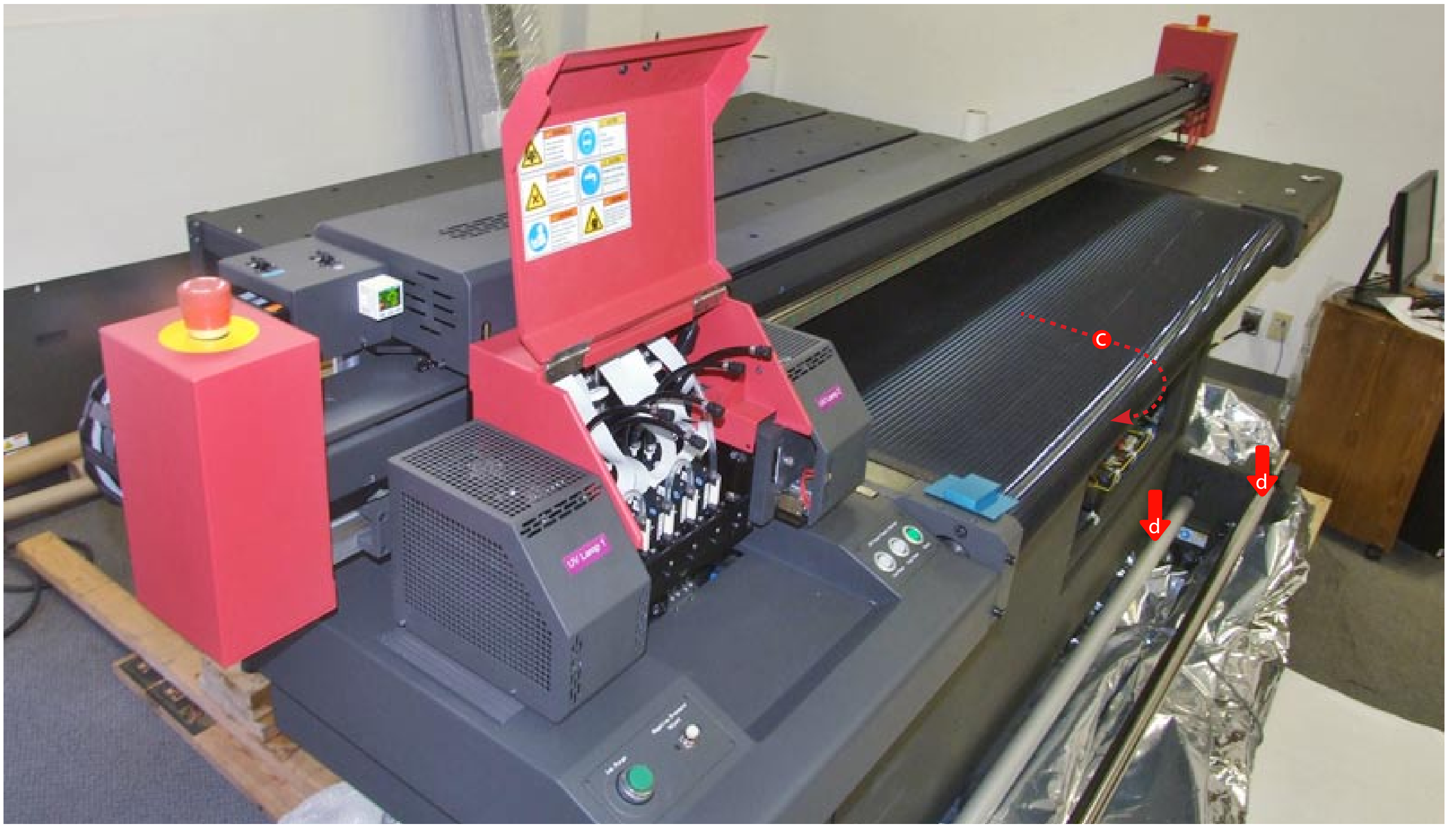
Dedicated flatbed or "true flatbed": this would be a printer that does not do roll-to-roll at all. Examples would be all Inca printers, Gandinnovations Jeti 3150 UV, the Mimaki JF-1631, Gerber Solara ion etc. So far, the NUR Tempo was the first dedicated flatbed that can also accept roll-fed material. But I am establishing a special sub-class for them, "Dual Structure". For the purpose of the basic anatomy of a UV curable inkjet printer, it's enough to concentrate on four basic categories: roll to roll, flatbed, hybrid, and combo.

The Luscher JetPrint 3530 is a dedicated flatbed. It handles only rigid media. This printer attempted to use LED curing before it was mature technology. Plus this company had never made a UV-cured inkjet printer before. The printer was also simply too large, and too difficult to service. After a few sales even the manufacturer realized this printer was not a success (clearly they read the FLAAR Reports). Finally this entire project was abandoned. So before you buy from a printer in this price range, be sure that the UV manufacturer intends to stay in business and can continue to provide tech support during the entire 3 to 5 year life of the printer.

A Hybrid UV printer can handle rigid materials and roll-to-roll but is really just a traditional solvent ink printer, modified to handle and cure UV inks, with add-on tables front and back. The materials are moved with a grit-roller held by a pinch roller. The ColorSpan 72UVR and 72UVX, the Mutoh flatbed (bio-solvent so far), and most Chinese printers such as Infiniti, Flora and Raster Printers, are of this hybrid design classification.

The ColorSpan 72uv series were hybrid printers. Most hybrid printers were solvent printers that were retrofitted to handle UV ink. As you can see in the photo at right, a table is incorporated to handle boards. This ColorSpan hybrid was a very successful UV printer, but most UV machines of this type of feeding mechanism tend to have problems with rigid media.

Combo (flatbed and roll-to-roll) is a new classification that needs to be recognized in order to emphasize the difference in design and movement of flat materials. Most combo machines have a belt-fed system (so no grit roller). Examples would be the Zund 215, Dilli NeoPlus (and hence the new Agfa and Mutoh OEM of the Dilli), GCC StellarJet K100uv, IP&I Cube, and many other printers. In most instances a combo design is better for flat rigid materials than is a hybrid.



The EFI Rastek H650 is a UV-curable combo printer. Combo printers are characterized by having a transport belt (c) that moves rigid materials into the printing area. A combo printer also has a roll-to-roll mechanism (d).

Some unique systems exist, that would be outside the basic classifications suggested above. A rare system concept would be the narrow-format Agfa :Dotrix. This has a page-wide array of printheads, and feeds from a continuous roll. The TURBOjet is a roll-to-sheet system, which is hardly ever attempted with any other printer.

Material does not move relative to the bed

It is easier to precision control the movement of the printhead gantry than to control movement of all the different kinds of rigid material. Flat material can vary from smooth surface of glass or marble to the rough surface of unpolished granite. Material can vary in weight from concrete panels to foam-cor. A grit-roller system (used in hybrids because this is what comes on a traditional solvent inkjet or water-based printer like an HP Designjet) will have a tough time moving some of these materials with the same precision as others. So high-end printer manufacturers, such as Inca, Luscher, Gandinations, and NUR, build dedicated flatbed systems.

Agfa :Dotrix at PRINT '05.

Dedicated flatbeds come in several versions.

- You can have the material and the bed both stationary
  - Sias Digital and its successor, Scitex Vision VEEjet+ (discontinued)
  - Oce T220 UV (discontinued)
  - Inca Spyder 150
  - Inca Spyder 320
  - Luescher JetPrint (failed)
  - Mimaki JF-1361 (entering retirement)
  - Grapo Manta (increasingly popular)
  - Raster Printers Daytona T600UV
  - Or the material can be fixed to the bed, but the bed itself moves, rapidly. This is the system favored by the
  - Inca Columbia
  - Inca Columbia Turbo.
- Or the bed can move slowly, one print pass at a time under a gantry that is stationary (obviously the printheads go back and forth as in any regular inkjet printer).
  - Gandinnovations Jeti
  - Teckwin TeckUV S2400, S3000

There are two unique versions of this classification: an optional flatbed attachment for the Zund 250 (discontinued) and the special flatbed mode for the otherwise combo-style WP Digital Virtu RS25 and RS25 (still available).

Material moves; bed (platen) does not move; flat platen: hybrid classification

Almost all UV-printers use this traditional approach, based on adaptation from solvent ink roll-to-roll printers. However the platens may be very different; the Zund 250 uses a complex dual-roller system, but is unique (other than a Teckwin hybrid which also has a dual roller system).

Most hybrid printers use grit rollers to move the material by contact; the grit is like sandpaper. The material is held against the grit rollers by pinch rollers from above.

Dedicated roll-fed printers tend to use tension rollers to pull the material from the back side from the front side (across the platen). These dedicated 3-meter and 5-meter roll-to-roll printers tend to use large heavy rolls of billboard, banner, mesh, or building wrap material. So they do not have the simple system of grit rollers: instead the media is held at one side and pulled with tensioned force from the other side.

Bed moves as a conveyor belt (transport belt): combo classification

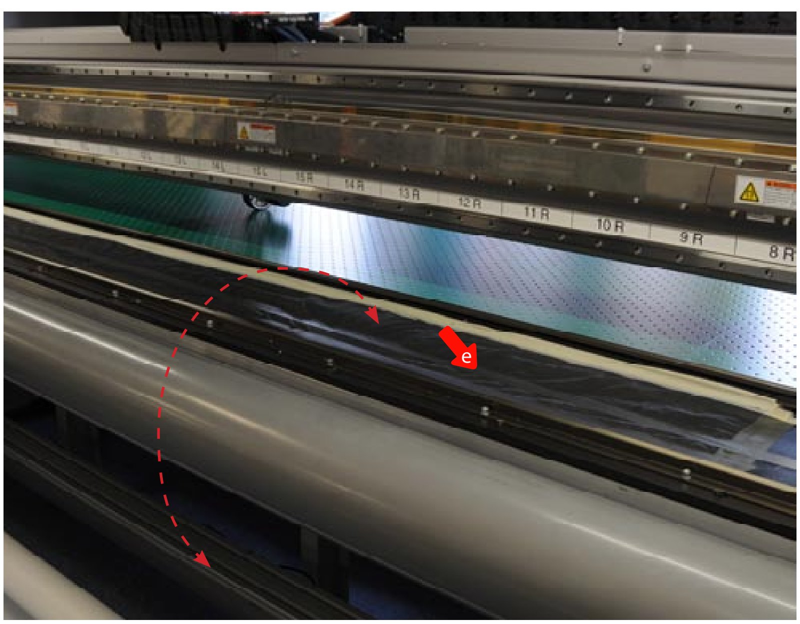
Normally the cheap and entry-level printers were hybrids (Gerber Solara UV2 and ColorSpan 72UVR and UVX, ColorSpan 5440uv, plus most Chinese printers). During this period all mid-range printers were combo style; high-end printers were dedicated.

Today these distinctions don't hold any more: there are entry level Chinese printers that are combos with transport belts. And there are mid-range printers such as the Keundo and the new Mutoh Zephyr that are hybrids costing in the $100,000 range, or more.

Although this printer was called Zund 250 Combi, it is actually a hybrid printer. In the lower photo you can see the pinch roller system.

The most sophisticated combo system is that developed by the L&P, both the American Virtu model and the Swiss Spuhl Virtu RS 25 and RS 35 models. It has two options, depending on the size of the material. It can move both the material, and the head assembly, in X and Y directions. Since late 2008 these printers are now named WP Digital Virtu, RS25 for 2.5 meter and RS35 for 3.5 meter.

The WP Digital Virtu RS35/36 UV combo printer has one of the most sophisticated feeding mechanisms.



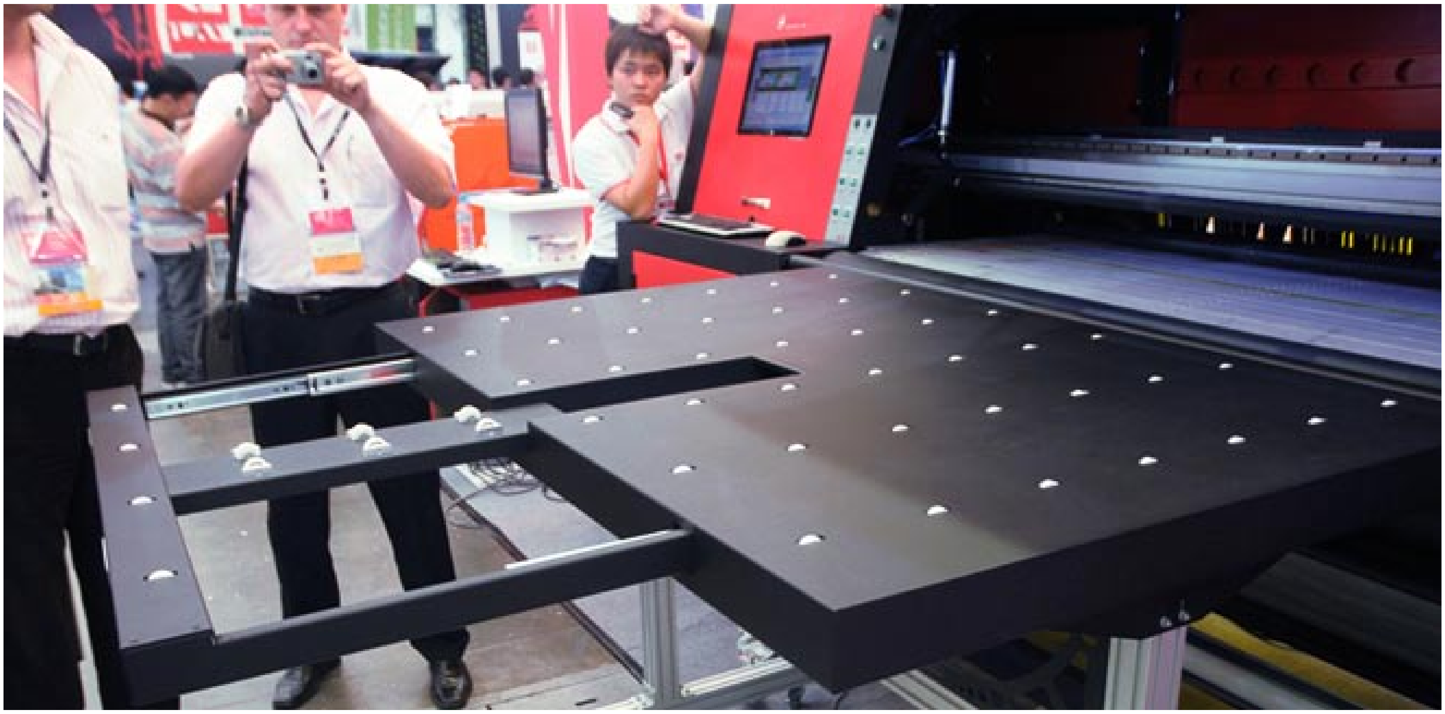
Besides the ability to handle traditional rigid and roll-fed media, it has a trough (e) to capture ink if you need to print on textiles, mesh or similar media. The photo at right shows the handle to move the trough upwards and downwards.

Anatomy of the flatbed feeding and take-up system

When you print with a water-based or solvent ink printer, the media or substrates are made for feeding through such a printer. The solvent printer manufactures know more or less what kinds of materials will be fed through their printers, so they can arrange the pinch rollers and all the rest of the feeding system to accommodate these materials.

But with a UV flatbed, people may run ceramic tiles, glass, or wooden doors through the printer. The manufacturer can't be expected to design a special feeding system for each coefficient of friction of the surfaces of these often radically diverse materials. So some materials feed better than others. The result with hybrid systems may be stuttering, slippage, skew: plus you get horizontal banding defects.

But even once the material is printed, it has to move all the way through the system and out the other end. A 9-foot length of wood, Styrene, Sintra, foamcore or whatever needs somewhere to go. This somewhere is the take-up table. Few take-up tables are large enough. Even the table for the over quarter-million dollar brands have feeding issues, as we found out when we ruined an entire door. It is amazing that the printheads were not destroyed in the process (Spectra heads are seemingly stronger than other brands).



Gongzheng GZU 1808AG at APPPEXPO Shanghai '09 trade show. The design of the tables will vary from manufacturer to manufacturer.

Let's look at some of the more common forms of roller feeding and take-up tables:

- Horizontal roller bars the full width of the table
- Horizontal roller bars with rigid supports in the middle and/ or elsewhere too
- Solid flat table with small roller bars
- Solid flat table with ball bearings
- Other designs?

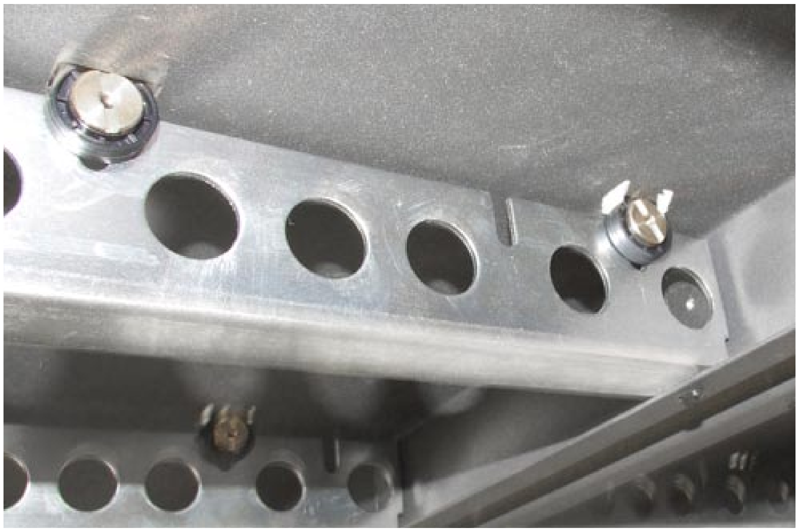


Photo taken from below the tables of the EFI Rastek H650. These are formed of three planks with tiny rollers that jut out in the surface to move media forward.

Month by month, model by model, the system of horizontal parallel rollers is being done away with by some manufacturers. But other manufacturers prefer this system. The Oce Arizona 60UV was delayed for month after month. One last-minute problem was seemingly the feeding and/or take-up system. At its first appearances in 2004 the Oce 60UV had traditional rollers. But the last trade show appearance (before it was finally cancelled all together), the take-up table was solid: no open rollers.

Horizontal bars with rows of rollers on the ColorSpan 9840uv.

Solid flat table with ball bearings on the DuPont Cromaprint 18uv.

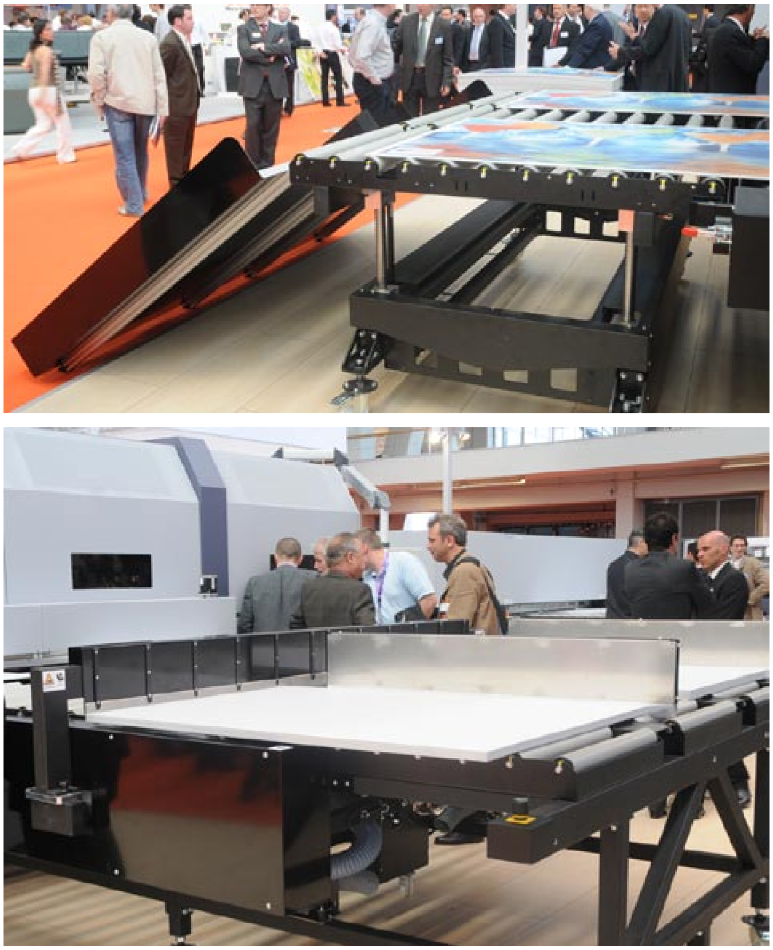
A similar story with the Flora 1800: when it was first shown in catalogs and/or at US trade shows it had normal horizontal rollers. Now the table is solid, with mini-rollers sticking up. It appears to be borrowing from the experience of DuPont.

Flora learns from DuPont because DuPont was pouring millions of dollars into improving the Flora 2200-series UV into first the DuPont DCC 22UV and now into the DuPont ChromaPrint 22UV.

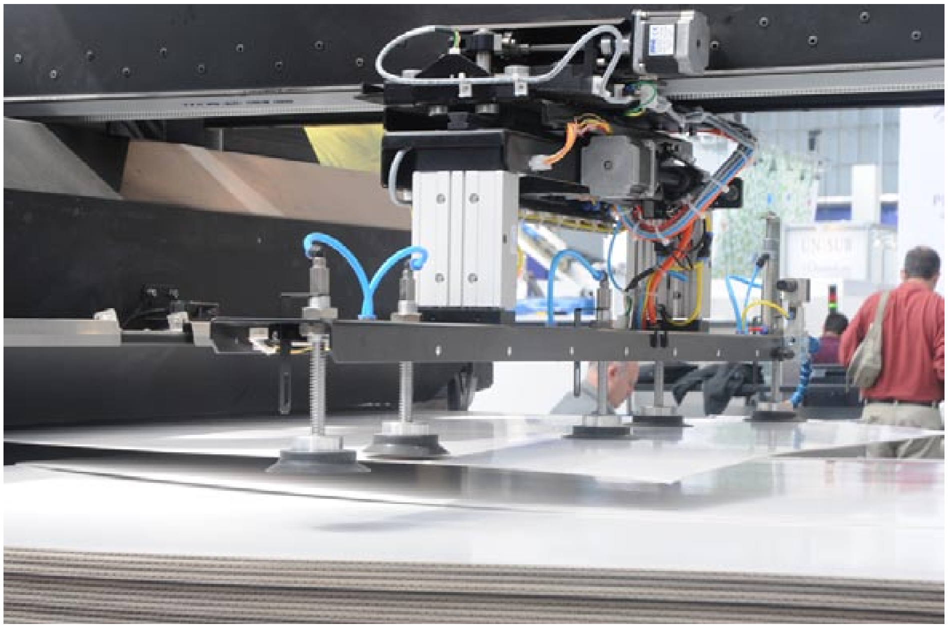
Look at the rollers on the original Flora model: then look at the table as seen in June 2005 (at FESPA trade show in Germany).

Why these changes? DuPont indicates that when materials are warped, that the lower part of the deformation can hit the front of the roller and stop for a split second until it is lifted up over the roller. Or in a worse case scenario, the material will jam. Either way you get a printing artifact. In most cases the client will reject this defective print. So you eat $50 or $70 or whatever that large rigid piece of raw material cost you, plus the ink and operator time, and headaches. But sometimes it may simply be cheaper to have a solid top surface. Plus, some materials may feed better on one type of table, and other kind of surface or weight may feed better on another type of table.

The improvements of these features is what you get when the manufacturer does not hurriedly push the machine on you. DuPont deserves top marks for spending more time and money in beta testing than any other company I know. Durst already went through the same process, but started earlier (before 2000). Inca started about 2000; Zünd started early too. Sias began already in the late 1990's. So these companies today are several years ahead of other companies in experience (the Sias printer ended up as the Scitex Vision VEEjet but it's 1990's design did not survive in face of competition from more agile UV printers with Spectra or KonicaMinolta printheads). Leggett & Platt introduced their first revolutionary Virtu concept in 2001. I can still remember that trade show. Their technology has been updated every year and is now in new format as the WP Digital Virtu RR50, RS25 and RS35.



Front and rear tables of the Durst Rho 1000 introduced at FESPA '09. At the front there are two parallel bins two boards at the same time. The feeding table is also designed to feed two boards at the same time. This type of feeding and take-up system speeds up the printing process because the operator can send to print without having to take time to remove the printed boards from the take-up tables.



The HP Scitex FB6700 has a system of suction pads that feed the piled boards into the printer. This system can be found in another industrial sized printers from HP and from other companies.

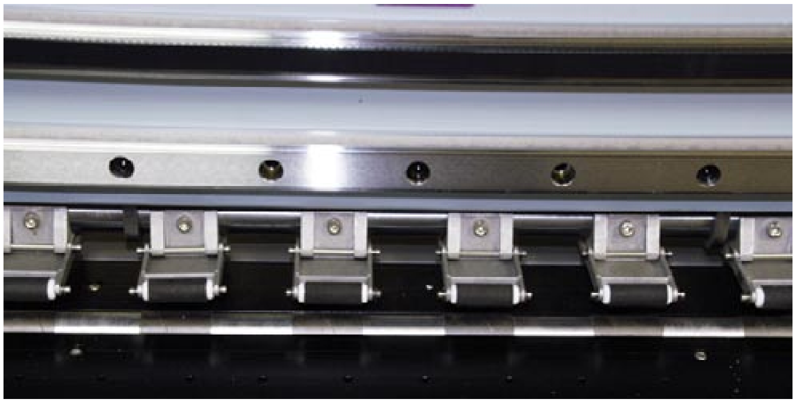
How is the Material Held Flat?

There are several ways to hold rigid material flat:
- A vacuum table
- Pinch rollers

Pinch rollers are as much for feeding the material as they are for holding it flat. Pinch rollers usually work in unison with a grit roller. The pinch roller is on top; the grit roller is at the bottom. But there are many variations and size differences of these roller systems.

Vacuum tables can be very expensive, as in five to fifteen thousand dollars, or more, depending on size. Vacuum tables are not as effective as you might wish; a vacuum table can keep a piece of foam-cor from sliding, but a vacuum table can't hold a warped foam-cor totally flat. In other words, a vacuum table does not suck most materials totally flat; at best it holds them relatively flat, and keeps them from sliding around.

So a few combo printers even use a roller bar at the top to help hold warped material down. One or two Chinese UV-curable flatbed printer manufacturers also try to use a raised bar over the flatbed to help keep down at least one end of a warped piece of material. It is not the fault of a printer manufacturer that most thick flat signage materials are warped.



An example of pinch roller.

An example of vacuum table.

UV-cured Ink

UV-curable ink has been used for many years in the screenprinting industry. But getting the ink to jet through a piezo printhead, accommodating the speed, and a host of other factors, was not easy.

When hit by UV radiation, UV-curable ink becomes a solid instantly. Once it is no longer a liquid, it can't enter the pores of the material. Since the material usually is solid, and has no ink receptor layer, the ink stays on top of the material. Indeed you can run your fingers over the image and feel the ink.

The substrate itself is (hopefully) stationary, but only for milliseconds. The ink itself is flying through the air. If the printer is running uni-directionally, the ink all lands in one direction, so to speak. But if the printer is bi-directional, a second droplet of ink hits from the other direction. Since the first drop is on top of the paper, in some cases the second drop lands on top of the first and forms a ridge of ink. You can actually see the rows of ink with a simple loupe. It looks like scrape marks, but technicians suggest it is a row of ink layers on top of each other.

The fact that the ink piles up can occasionally be used to a benefit. Four years ago a Mimaki manager was building up depth of ink on elevator signs with the floor numbers written in Braille, where the blind need 3-dimensional symbols to read them with their fingerprints. So here is a new application. But in normal applications you do NOT want 3-dimensional grain pattern on your signage. Yet Sun LLC is producing gorgeous raised-relief prints: 66 passes (3 print runs of 32 passes each run).

Nicholas Hellmuth at a UV ink lab, factory visit, 2007.

In a normal water-based or solvent-based inkjet system, you have to consider the ink and media as a system that interact with each other, especially for water-based printers where the media has an inkjet receptor coating. The chemicals in the coating determine the color gamut and other properties, almost as much as do the components of the ink itself.

In a UV-curable inkjet system you also have to optimize the UV-curing lamps with the ink. Since the lamps are expensive components of the system, you can't simply develop a better ink and assume you have a better printer. This is one reason why the better inkjet printers today are a joint venture between an ink company and a printer manufacturer: Sericol (ink) and Inca (manufacturer) is an example of such a successful joint venture.

Ink needs the following attributes desired by the end-user: [1]

- Hardness, to resist abrasion and increase scratch resistance
- Adhesion, to stick to greater variety of surfaces
- Flexibility, to flex without cracking on non-rigid materials
- Lightfastness
- Surface finish (gloss or matte)
- Texture (preferably no texture)
- Color gamut (problems obtaining some reds)
- Color opacity and saturation
- Chemical resistance to cleaning solvents
- Minimal shrinkage
- Minimal wrinkling

Ink needs to have the following attributes necessary for the printhead system.

- Shelf life
- Speed at which the ink cures
- Stability in the printhead
- Low wetting characteristics [2]
- Avoiding gelation

Sartomer is one of several leading companies that make the monomers that are key ingredients in UV-curable ink. Additional publications by Sartomer, including by James Balcerski, are useful if you wish technical information. You can obtain many of the informative Sartomer White Papers on www.sartomer.com or www.radtech.org.

Baldwin (2004:8-9) lists the components for UV-curable ink:

- Acrylate monomers[3]
- Acrylate oligomers (partially polymerized monomers)
- Photoinitiators, active to wavelengths of UV light.
- Surfactants (wetting agents needed by the printhead jetting system)
- Pigments and their dispersants (colors)
- Inhibitors (to reduce the chance ink will be cured prematurely by low light).

The printing system must control air getting into the system and minimize gelling of the ink. When white ink is used it must be kept stirred or otherwise prevented from settling.

Shelf life of ink is a touchy subject too. Heat in storage induces gellation. Heat from the need to heat the ink to provide adequate viscosity for it to jet is another cause of gellation. So although heads don't clog from drying ink, they do clog from gelled ink. Baldwin provides close-up photos of almost all these problems. He also recommends not to use brass fittings in a UV ink printer.

UV ink can gel, swell, and dissolve parts of printer ink lines.

[1] Paraphrased from IMI UV conference report of James Goodrich, Sartomer Co and a separate paper by David Snyder, EIT Instrument Markets. Some features were suggested by information in papers by Alan Hudd, David Snyder, and by Richard Larson, from their separate papers in the same IMI UV conference.

[2] Alan Hudd, IMI UV conference, discusses surface wetting, as do some other conference participants at the same conference.

[3] Monomers are discussed in more detail by articles published by Sartomer Co. Other ink ingredients are provided by UCB.

Hudd lists the primarily ink suppliers as being

- Sericol
- SunJet
- Avecia
- Akzo Nobel
- Xennia
- Jetrion (Flint Ink)

Since then many more ink companies have entered the market, such as Triangle Digital, Sun LLC (Novosibirsk), and KonicaMinolta (which is more than just Toyo ink).

Based on what we have seen at trade shows in Germany and across the USA for several years, the ink that provides the best color gamut is from one or two brands; the ink that is weakest is from a few other brands. We are not familiar with which printers use the inks from Avecia, Akzo Nobel, Xennia, or Jetrion. In past year most printers use Sericol (Inca, Oce) or SunJet (Durst, ColorSpan, Gandinnovations, etc.)

Toyo ink booth at DRUPA 08.

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

Different kinds of UV Ink

Not only are there now more than 10 different companies making UV-curable inkjet ink, but there is more than one kind of UV-ink chemistry. If you are printing primarily on corrugated packaging materials, you may wish a special UV-cured ink just for boxes. Durst offers such an ink for their Rhopac printer.

If you need to print on flexible material, especially material that will wrap vehicles (and have to go over rivets and around corners), then the ink film must flex. If the ink film breaks, that is not good. So a special ink is needed to print on flexible material.

Then there is rigid material; the ink needs to affix itself well to rigid surfaces too.

Most end-users prefer a generalized combination ink: something that is flexible enough for roll-feed material yet that still sticks well to rigid materials. Such a combo-ink will flex, but perhaps is still not ideal for vehicle wrap (but good for everything else up to vehicle wrap requirements).

Durst and NUR seem to offer a helpful variety of inks. Just keep in mind the rigors of changing ink and flushing out the old ink. Most really large printshops will have more than one UV printer: one for flexible ink (roll-to-roll printer); one for thick rigid materials (combo, hybrid, or dedicated flatbed). A dedicated flatbed will have a dedicated flat ink; a combo or hybrid or dual-purpose flatbed will need a half-flexible half-rigid ink, so a generic chemistry.

FLAAR now offers a separate Report on UV-curable inks so that you can have pertinent useful overview all in a single PDF.

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

Hexion 3D Plastic booth at FESPA 07.

Avoiding Gelation of the UV Ink

If UV ink gets too hot, it can gel. Gelled ink can gum up the printheads and affect output quality. Since most UV printheads have to be heated to handle UV ink, gelation happens if the ink is not insulated when it ought not to be heated.

A major cause of gelled ink is when old ink builds up in the on-board ink reservoirs. This happens when new ink is poured into the reservoirs before the reservoir is 100% empty. Normally you would never 100% empty an ink reservoir, because then the printer would not print and would potentially suck air into the ink lines. The best way to avoid build up of old ink is to take the ink container on board, remove it, throw it away, and add the new ink in its own new-ink container. So gradually many printers are switching to this method of adding new ink.

In past years, merely stirring the old ink may not be enough to avoid gelation. But today there are enough filters and the ink is better to begin with, so gelation is not as much of a problem in 2009 as it was in 2001-2005.

Different kinds of UV Ink

Not only are there now more than 10 different companies making UV-curable inkjet ink, but there is more than one kind of UV-ink chemistry. If you are printing primarily on corrugated packaging materials, you may wish a special UV-cured ink just for boxes. Durst offers such an ink for their Rhopac printer.

If you need to print on flexible material, especially material that will wrap vehicles (and have to go over rivets and around corners), then the ink film must flex. If the ink film breaks, that is not good. So a special ink is needed to print on flexible material.

Then there is rigid material; the ink needs to affix itself well to rigid surfaces too.

Most end-users prefer a generalized combination ink: something that is flexible enough for roll-feed material yet that still sticks well to rigid materials. Such a combo-ink will flex, but perhaps is still not ideal for vehicle wrap (but good for everything else up to vehicle wrap requirements).

Durst and NUR seem to offer a helpful variety of inks. Just keep in mind the rigors of changing ink and flushing out the old ink. Most really large printshops will have more than one UV printer: one for flexible ink (roll-to-roll printer); one for thick rigid materials (combo, hybrid, or dedicated flatbed). A dedicated flatbed will have a dedicated flat ink; a combo or hybrid or dual-purpose flatbed will need a half-flexible half-rigid ink, so a generic chemistry.

FLAAR now offers a separate Report on UV-curable inks so that you can have pertinent useful overview all in a single PDF.

Materials used in the printer construction

All the materials used, especially in the ink lines, have to be compatible with UV-curable ink. The first generation of most brands of Chinese printers simply took standard solvent printers and added a UV lamp and UV ink. I saw two of these where the ink lines and even the connectors simply dissolved. Today of course everyone has learned and things are much better. Teckwin and Flora have significantly improved the printers that they deliver in 2009. I have inspected an RTZ-made combo-style printer at a FastSigns franchise sign shop outside Philadelphia, and he is content with this Daytona model (from Raster Printers; same model is now available from EFI Rastek). So most printer manufacturers learn from experience and hard work and their products at ISA, FESPA, SGIA, and VISCOM are better than in past years (in most cases, sadly there are a few models from other manufacturers which are not quite as good as we would wish them).

Flushing (cleaning) Liquid

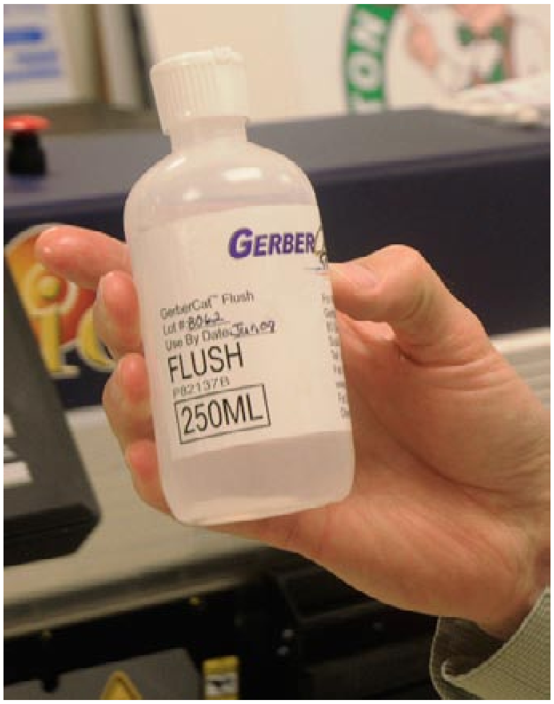
Officially, there is supposed to be no clogging with UV inks unless they are hit with UV light. In reality this is not entirely true. There can be dark-curing whereby the constant heat within the printhead causes gellation. Ink can go bad in other ways too, such as being over the shelf-life period. Indeed the ink is sufficiently problematical that most companies are switching from large containers to smaller 1-liter bottles. These problems come primarily with time; when it is fresh its better.

There is some misting, so ink is floating around as a fine cloud within the printer (it's much worse with solvent ink, but UV ink mists also).

And printing on dusty material, or on fabric with loose threads, will cause clogging.

So printheads do get clogged, both with UV ink and debris. To counter the clogging it is necessary to flush the printheads. This usually means forcing ink out the nozzles to push debris away. But sometimes you need a solvent material. This is sometimes called flush material.

A few printers have the flush arranged so that you can actually get the machine itself to run the solvent through the ink tubes. You may have to switch the access manually (Raster Printers), or perhaps use software commands. The machine draws flush from a reservoir and pumps it through the heads. When you are through, you have to switch back to the ink, and pump enough ink through the system to remove all the flush (the mixed ink+flush won't cure properly).



Flushing (cleaning) Liquid

On many systems you need to inject flush solution yourself into the ink lines with a syringe.

But other printers have no mechanism for getting the flush into the printheads; with these you have to dip the printheads in flush or wipe the printheads with a cloth. Wiping eventually may cause wear and tear on the delicate nozzle plate.

UV Curing Lamps

We were commissioned by a leading US trade magazine to research and write up the lamps and curing technology. After this appeared in the trade magazine we issued a longer version as a separate FLAAR publication. What you need to know beforehand is that UV lamps for curing the ink come in several technologies: mercury arc, LED, and "other" (used by Gerber). Mercury arc come in several kinds: continuous (with and without shutters), flash, and microwave. Most printers have two lamps (one in front of the printheads for the uni-directional path; one "behind" the printheads that is in front during the return pass for bi-directional printing).

Most lamps can be set at high or low settings; or off. Raster Printers offered a mask to further moderate UV radiation on the substrate.

Lamps tend to last about 1000 hours (it varies by manufacturer). Then you need to replace them, both at the same time generally.

You need to replace the reflector after you have replaced the lamp twice or by its third replacement.

UV lamps from Dr. Hönle at FESPA Digital 2008

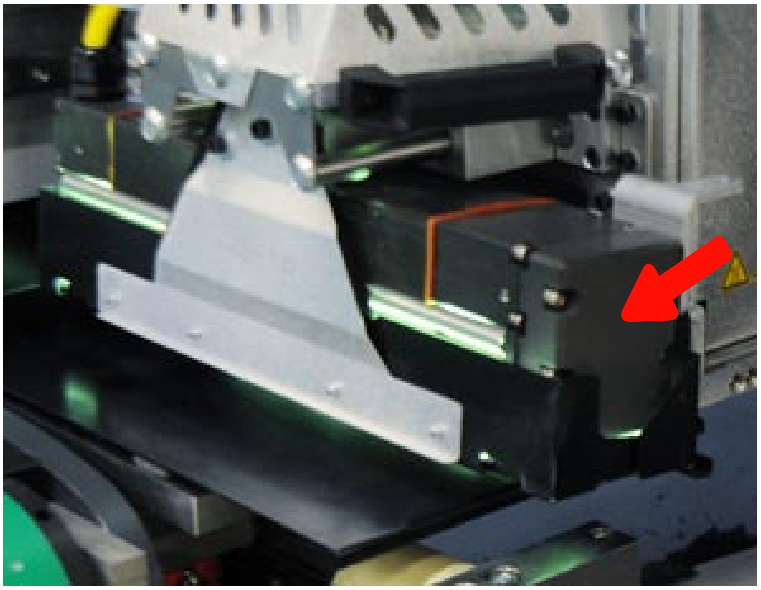
These replacements are considered consumables and are not included in most parts warranties. Replacement can be done, carefully, by the users. The Oce T220uv had the most complex replacement procedure that we have seen so far. Most other lamp replacement would take less than half an hour even the first time.

The UV curing lamp is one of the most important parts of a UV printer, but is virtually ignored in the spec sheets. At most trade shows rarely do personnel in the booth know even what brand of UV lamp is in the printer, or how it operates. Yet in the year 2002 report by Klang and Balcerski (Sartomer), "New Developments in the Commercialization of UV Curable Inkjet Inks" they clearly state that improvements in the then clunky UV-lamps (inherited from other technologies) would be required before UV-inkjet printers could take off in popularity. This crucial need to improve UV-curing, and for the end-user to understand what the curing technology is, is why FLAAR has devoted energy to preparing our special separate report on UV curing.

The aspects of UV lamps relative to the anatomy of a printer are the need for a small size, since they have to physically be attached to the printhead carriage. For the same reason you need the lamps to be lightweight. On both counts micro-wave UV lamp technology are large and heavy. As a result this kind of UV lamp is used only on a few printers, such as the NUR Expedio.

The lamps ought to have shutters. Shutters are to protect the platen and substrates from heat and UV light when the printhead carriage is at either far end of its run.

To assist in lowering the heat, the UV lamps require cooling by air (fans) or water. The downside of air cooling is that you can't have uncontrolled air drafts causing the jetting ink to blow off course.



The UV-curing lamp at WP Digital RS35 has shutters of an intelligent design that are both more effective, and, since they are cleverly situated, they are not as likely to cause problems.

Another aspect of printer design is how to shield the printhead nozzle plate from the UV light. Especially if you are printing on a shiny surface, such as a metallic, or even a shiny marble, the light could reflect back up into the nozzles. If ink solidifies either on the nozzle plate, or worse, up inside the nozzle channel, then the printhead has to be replaced. A new printhead, and installation, can cost between $1500 and $4000.

Reflectors are another crucial aspect of UV curing lamps. There are various sizes,shapes, and kinds of reflectors.

LED systems now allow cooler curing systems. Gerber has another form of curing that does not use LED but is less heat than mercury-arc lamps. Downside of cool curing is slowness, since the lights have to dwell over the material for a longer time. But as with everything else in UV printers, the curing technology gets better every year.

The UV Curing Process

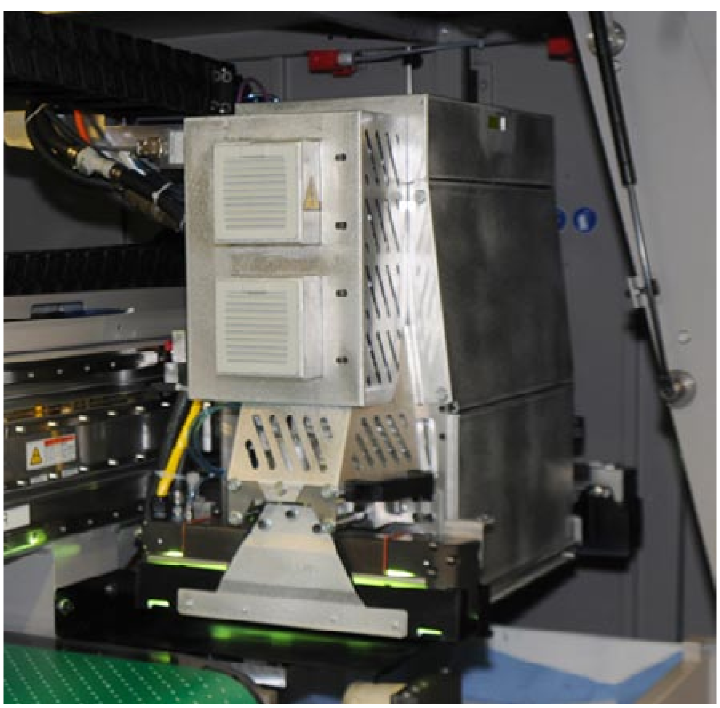
The idea is that the UV light will turn the liquid ink into a solid within microseconds. But before you think this is a simple process inside a printer, check out the various technical papers in the IMI UV-curable ink "Proceedings," such as the paper by Richard Stowe, Adrian Lockwood, and by Peter Schwarz-Kiene.

The printer design has to keep stray light away from printheads; you don't want non-printing ink to solidify (cure) on the surface of or inside the nozzle. Since newer better inks have the downside of light cure, they may be sensitive to sunlight. As a result you have to protect the ink and printheads all the more. In addition to protecting the printhead from extraneous light, you also have to protect it from reflections from any shiny printable materials back up into the printheads. Some printers should never be used to try to print on mirrors, shiny metal, shiny polished stone, or other surfaces that may reflect the UV light up inside the ink jetting system. Most printers now have their UV lamps at a slight angle, so they can at least print on shiny Dibond aluminum.

Don't assume that the ink is really cured by the UV lamps. The intent is to cure the ink, but a full cure is by no means what actually happens. When you try to lay down extra ink for backlit mode, I would be curious to know how this doubled ink density is cured?

And what about printing in glossy mode? Not only is more ink laid down, but the lamps are dimmed. The result is incomplete curing. If the amount of odor emitted is any indication that the curing process is still going on, then I can report that this curing process takes about two weeks (on synthetic material (Styrene or Sintra), Durst Rho 160, set to glossy mode). Indeed the material emitted so much unpleasant odor that we had to remove it from the room for several weeks.

To learn more about the actual curing process we recommend you attend one of the IMI conferences on UV-curable inkjet technology. You can see their programs on www.imiconf.com and www.imiEurope.com. Conferences are held in the US and in Europe.



Water-cooling carriage for the UV lamps, at WP Digital factory 08

UV lamp cooling, at WP Digital factory 08

Protecting against Static Electricity

When the material receives a static charge then the entire surface of the printer attracts ink. The ink is drawn to the entire surface of the material, even outside the area of the intended design.

Static charge will be worse in dry environments (such as during winter with central heating), or in an area with rugs, or if the material itself comes with a static charge because it is rubbed (while cleaning, for example).

To protect against build-up of static charges on the material most printers are grounded and some printers have static bars. One printshop said that the brand of UV printer he bought had such a static problem that it was almost unusable. He saved the situation by acquiring a retro-fit system from Bob Fraser's company, Fraser antistatic, in the UK.

Michael Boesch explaining the importance of a color management check system.

Colors differences relative to the printing sequence

Stowe points out that even the sequence in which the ink colors are jetted affects the results. He indicates that curing is affected when black ink builds up over yellow ink (Stowe 2004). The UV must penetrate opaque colors too (Snyder 2004). The difference in the depth of cure results relative to sequence of color laydown is especially true with white ink.

DuPont was one of the first companies that has figured out how to arrange the ink lines so that printing in the back-direction (the second pass in bi-directional mode), lays down the ink in the same color sequence as the ink is laid down in uni-directional mode.

Color Management and ICC color profiles

It is essential to be able to do your own custom ICC color profiles. It helps to have an industrial-strength RIP software. There are several valid options but Caldera is the one we know the best. BARBIERI is the color management equipment that I am most familiar with.

BARBIERI electronic spectrophotometers have the advantage that they can read automatically backlit material, glass, and acrylic (Which most other spectrophotometers are not able to read).

Materials to print on

We cover materials to print on with UV-cured inkjet printers in a separate FLAAR Report. In some instances the materials you are printing onto may need an ink receptor primer. This can either be included on the material from the factory or can be a primer that you add yourself. The latter implies considerable extra labor and you need to be sure you can coat the material evenly.

The whole idea of buying a UV-curable inkjet system includes the same concept as buying a solvent ink printer: you want prints for outdoors that don't require lamination and on materials that do not require expensive coating (primer). However with UV-curable this goal is more elusive in part because although the ink may hold up to the light outside, but won't hold up to handling: abrasion and adhesion are the two main issues here.

Thus it comes as all the more surprise to learn that you may indeed have to post-treat the material as well. Paul Yandell suggests:

- Varnish for durability and/or anti-graffiti protection
- Varnish for added protection against sunlight
- "surface visual finish—high gloss or matte"[4]

Learning about the Mechanics of Flatbed Printers

You could write a PhD disseration on the motors that power the transport belt and/or the printhead carriage. A weak, outmoded, or imperfect motor is an invitation to lack of print quality. So, sorry, it does help to ask questions about what kind of motor is used. Try at least to avoid a stepper motor.

The best test of a printer is to give it an image with lots of large areas of dark color, especially black. If you get banding lines, be wary.

Conclusions

Every aspect of UV-curable ink printers has advanced in the last three years. Ink formulations and printhead engineering are leading the way. In other words, the ink used today is dramatically better than the ink first offered in 2001 and 2002.

The UV-curing aspects are improving each year. Manufacturers now see a growing market for their products and are willing to devote R&D dollars to make products tailored for the needs of inkjet printers, such as smaller size, drastically lower prices, and less heat emission (Lockwood 2004).

Thus beware of buying any used UV curable ink printer that was manufactured in 2001 or 2002. I would expect a major price savings on any used printer manufactured in 2003. Used printers from the top tier companies that were produced in 2004 onward are acceptable. Avoid, however, printers that were phased out because they had defects: the Luscher is the most obvious, but there are a dozen other used models that I myself would not touch.

We wary of a price that is suddenly lower than the price of the same machine a year ago. This may be a sign that they are reducing inventory because that model had troubles and not many people want that model any more. There are several flatbed printers today whose resale value will be very low because these printers were found out to have old-fashioned components. So if the price is "too good to be true" this may be a sign that the printer has been discontinued. What you save today in the lower price you will lose in resale value several years later, plus you may yourself experience all the imperfections and issues that are causing this printer to have its price reduced.

The best reason for learning about what goes on inside a UV printer is because so far about eight flatbed printers have failed. The most notable are:

1) The Oce Arizona 60UV had the wrong lamp technology and a host of other problems: mainly they tried to make it too low-bid all across the board, plus they were using a chassis that was originally made for solvent ink and/or oil-based ink. It was a retrofitted model. Roland is the best example of retrofitted (solvent and eco-Solvent) that show that retrofitted sometimes come close to "jerry-rigged."

2) The DJT, DigitalJet Technologies never made it to a trade show. They had a booth, but no printer (never a good sign). Probably they ran out of operating capital.

3) Azero Creon could not survive with their nice but costly and complex UV printer from Hypernics in Korea. It was rumored that Azero also ran out of operating and developmental capital. The engineers who left Hypernics formed IP&I; their printer is quite nice.

[4] (Yandell, IMI UV conference, 2004). Paul Yandell, Sericol Imaging.

4) Tampoprint has not yet successfully gotten into UV-cured flatbeds. They are still attempting to make a solvent ink flatbed that works acceptably. Their attempt at DRUPA 2004 was unsuccessful. We will learn more at SGIA 2006.

5) The Luscher was a half-million dollar made-in-Europe printer that was too much, too soon. It had imperfect technology and is the best example of buying a printer without first reading a FLAAR Report that might warn you of potential issues.

6) The DuPont UV printers failed in the marketplace for many reasons, primarily because their original design was a first-attempt by a company that previously had made only low-priced solvent printers.

Obviously we do not know every defect of every printer, and printers that we like can have defects that show up on another manufacturing batch. Always speak with another printshop that already has the printer you are interested in, and be sure to test your image files and sample client files before you buy.

The

- CrystalJet,
- Konica Iguazu,
- Kodak 5260,
- Encad-Kodak VinylJet,
- and Tiara printers

are others that have failed due to flawed technology or inadequate ink chemistry. Kodak probably blew over 30 million dollars on the 5260 and tried month after month to sell it (even though the printer seemed never to function without a Kodak tech person on full-time duty). The more recent printers that have failed are all UV:

- Zund XY-flat (tried to use Epson printheads with UV inks)
- Eastech UV printer that also tried to use an Epson printhead

The PIT printer was either stalled, or failed. It probably had funding problems too. The next Oce printer (shown at SGIA 2006) has been delayed month after month.

Sometimes a very simple printer (such as the ColorSpan 72UVR and UVX) work better than a really complex printer (the ill-fated Agfa :Anapurna 100; the same machine as the Mutoh Cobra 100). This Mutoh-Europe-made Agfa printer had every neat gizmo and fabulous new technology you could possibly imagine. It was a dream machine; the ultimate toys for boys for the engineers. Unfortunately they forgot that all these innovative features

- Had to work together
- Had to be manufacturable
- Had to be workable at a reasonable cost

Another cause for demise in the marketplace is old technology that gets stale in comparison to what competitors offer. The venerable Scitex Vision VEEjet had this problem from the beginning.

We are not soothsayers, and a printer can easily have flaws that we are unaware of (and can have great features we may not notice too). But we do our best to learn as much as we can. Generally the documentation and commentary from FLAAR has proven to be more accurate than what is available on the Internet such as in overly enthusiastic PR releases.

Feedback from you is welcomed

This edition was prepared as a handout at ISA. We are considering offering an update as a handout at FESPA Digital a month from now. If there are aspects of UV-cured inkjet printers that you feel should be added, or substracted, please let us know at FrontDesk@FLAAR.org.

Bibliography

IMI organizes outstanding conferences on wide format printers. IMI, in particular, has seminars on industrial wide format (which is UV cured printers). Since FLAAR attends these conferences (and occasionally lectures on topics other than UV cured inks) we have all of their reports. These conference proceedings have been utilized as background reading prior to updating the present FLAAR report.

We have a separate glossary with a larger bibliography and also a separate bibliography in additional FLAAR Reports in the UV series.
Most recently updated April 2009.

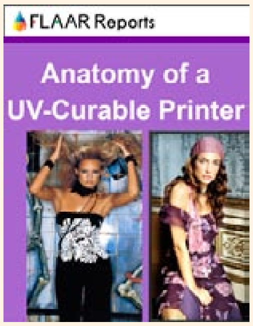
First issued July 2004 based on observations at DRUPA trade show in Germany. Updated September 2005. Updated November 2005, April 2006, April 2008.

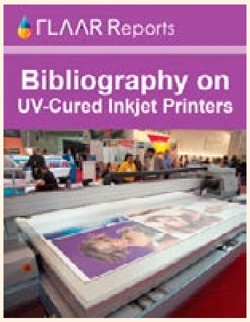
These are some of the most

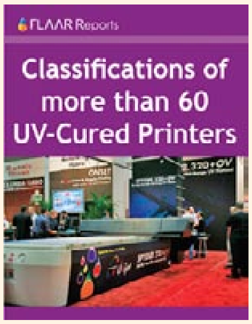
Recent FLAAR Reports (2007-2009)

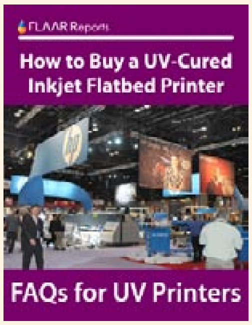
You can find these and more reports at: www.wide-format-printers.NET

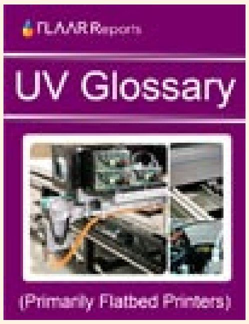
Introduction to UV Curable Inkjet Flatbed Printers

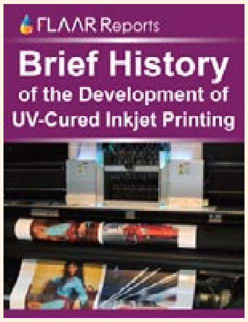


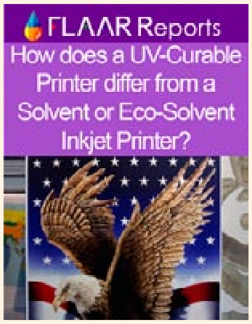


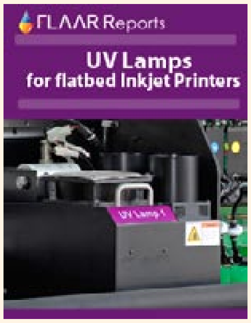


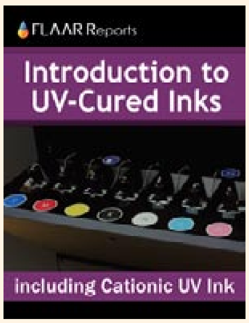


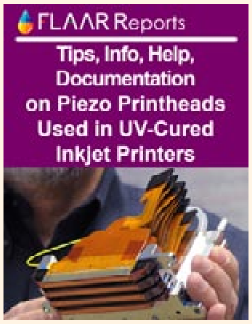




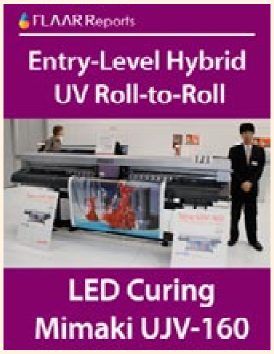


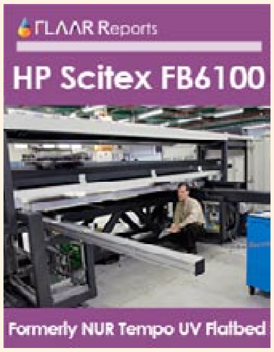


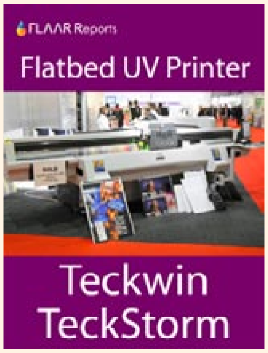




Most recent UV Printers





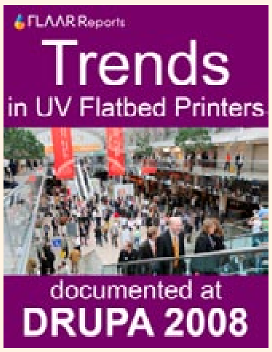


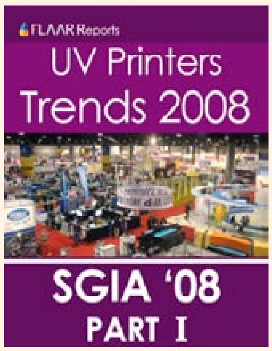
These are some of the most

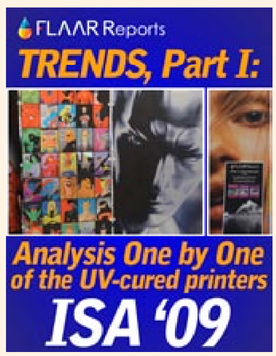
Recent FLAAR Reports (2007-2009)

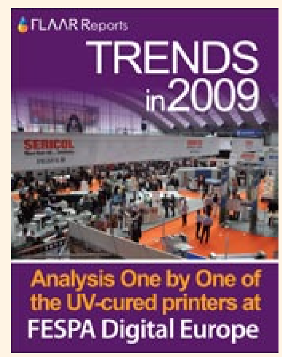
You can find these and more reports at: www.wide-format-printers.NET

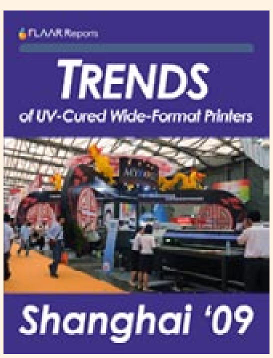
Comments on UV Inkjet Printers at Major Trade Shows 2007-2009

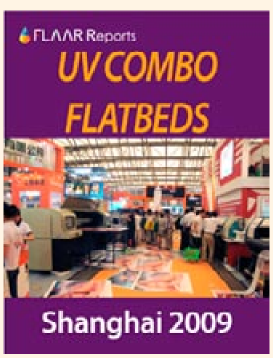


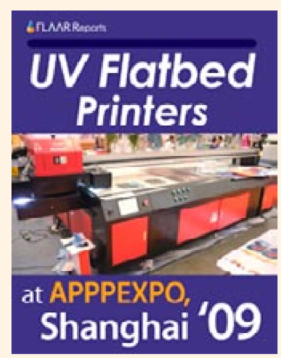












UV Printers Manufactured in China, Korea and Taiwan