FLAAR Reports

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Updated January 2008

Direct Digital Printing on Fabrics with Wide Format Inkjets

Caption for front cover:
Ujet MC22, Yuhan KCC textile printer.

Contents

Introduction 1
Ancient History: Electrostatic Printing 4
Inks for Textiles 4
Sources of inks 6
Inkjet Printers for direct printing on textiles 7
ColorSpan 7
Compedo 8
Hewlett-Packard DesignJet 9
Piezo-Electric Printhead Systems for Printing on Textiles 10
Mutoh 13
UJET MC2 from Yuhan-Kimberly 13
Italian retrofitting of Roland printers for textiles 17
Industrial Inkjet Textile Printers 17
DuPont 17
Steaming and Setting the Colors When Printing Directly 19
Washer and Dryer for finishing your inkjet textiles 20
Dye Sublimation and Heat Transfer 20
Textiles and Fabric to Print On 21
Translucent Dacron 21
Colorfastness 22
UV-curable Inkjet Printers for Textiles 22
Further Information 22
Conferences on inkjet textiles 22
Upcoming Evaluations 23
Glossary of Terms 23
Bibliography 24
Relationships with other universities and Institutes 26
Follow up 26
How Are Evaluations Accomplished by FLAAR? 26
Reality Check 27
Update Policy 27
Citing and Crediting 28
Legal notice 28
Factors influencing output 30
Acknowledgements 32

Introduction

Printing on textiles with inkjet printers is a growing trend around the world. More and more companies are producing improved textile inks and printers. 2008 is a good year to get into textile printing with wide-format printers.

FLAAR is inherently interested in the following aspects of textile printing:

- Soft signage: printed fabrics move in the wind and hence attract more attention than a dull boring traditional billboard.
- Exhibit booth decoration at trade shows: you can print entire trade show exhibit booths with “walls” made out of fabric.
- Wallpaper: you don’t need to have your house look like your Grandmother’s style: you can put your own photos on your own personalized customized wallpaper.
- Many other kinds of interior decoration can now be done with fabric printers.
- Fine art photography and all other kinds of photography: print your next exhibit on silk!
- Fabric design samples.
- Short-run production of customized fabrics for clothing

Wallpaper samples in the exhibits and demo room spaces of Yuhan-Kimberly.

Additional samples of inkjet printed textiles from Yuhan-Kimberly, a company that makes innovative textile inks and a wide-format printer that can handle printing on textiles: even on fabrics that are thin and stretch.

Here is Nicholas Hellmuth in FLAAR Mesoamerica office with some samples made in Yuhan Kimberly.

You can print murals and banners on a wide variety of textiles and fabrics. Many normal large format inkjet printers print nicely on textiles. HP Designjet printers such as the 5000 and 5500 are good examples.

This report provides information about the textile printers that we looked at during the trade shows, most recently during 2007. But we gathered a lot of information especially from DRUPA 2004 and FESPA 2005. We have taken notes for years, including at PMA '03 and ISA '03. Earlier we had also studied inkjet textiles at CeBIT computer trade show in Hanover, Germany in March 2001, DRUPA printer trade show in Duesseldorf in May 2000, and DPI in April 2001. Interest in printing on textiles is rising to the point that at the Seybold trade show (San Francisco 2001) in late August and especially Photokina in September 2000, we gathered additional information so we can offer further facts and sources relative to your questions about printing on textiles. At the Big Picture Show in Tampa we took notes on other printers for textiles. This report has been updated after the new season of trade shows during 2002 through 2003 and already several tradeshows during 2004. It turned out that FESPA 2005, in Germany, had more displays on inkjet printing of textiles than any other general trade show in the last five years. So we have issued a separate report on what we saw at FESPA 2005.

Another great place to learn about inkjet printing on textiles is to attend the specialized conferences offered by IMI. Their website is www.imiconf.com. Their headquarters are in Maine but the programs are offered in various locations in the US and Europe too.

Basically in past years you could use a ColorSpan, Encad, Mimaki, Mutoh, and almost all the Hewlett-Packard DesignJet inkjet printers to print directly onto textiles or for subsequent heat transfer. Today people interested in printing on textiles look at specialized printers that are dedicated just for printing on fabrics, such as printers from Mimaki, Yuhan-Kimberly, d-gen, etc. Perhaps it's helpful to you if we review the various options that are available.

This report does not cover
- Electrostatic printers for printing onto transfer paper (a dying technology)
- Industrial flatbed printers using UV-cured inks (we have 53 reports on those)
- Printing on textiles with solvent ink printers (we have a dozen reports on this technology)
- Other industrial printers.

But this report definitely does cover
- Direct printing on inkjet textiles with regular inks
- Direct printing on inkjet textiles with textile inks

Separate additional FLAAR Reports cover
- Dye sublimation heat transfer (print on transfer paper; transfer via heat from the paper to the to textile)
- Electrostatic printers (dye sub via transfer paper) and grand format solvent ink printers

- UV-cured ink printers for textiles are mentioned in the FLAAR Reports UV-flatbed printers.

Though obviously textiles are neither thick nor rigid, UV cured ink printers tend to be flatbed printers which are made for objects which are thick and rigid but newer models are coming out, such as the Durst Rho 351R, which are only for roll-fed materials, which makes it easier to print on fabrics.

So this report covers direct printing onto textiles with water based inkjet printers. Indirect printing requires heat transfer and disperse (dye sub) inks. That transfer requires that you initially print onto paper and then feed the paper through another expensive machine to heat the paper, which turns the colorant into a gas, which impregnates the fibers of the adjacent cloth.

Many people prefer to do heat transfer, but so far we do not have any of the transfer equipment. We prefer to evaluate what we use ourselves or what is installed in companies near to our university in Ohio.

With our Hewlett-Packard DesignJet 5000 or Mimaki JV4, we just feed the fabric into the printer the same way you use photo-glossy or any other media. Many companies make fabrics specifically for the HP DesignJet printers. You just have to be sure that the fabrics are coated for inkjet usage. Most of these fabrics come with their own paper backing so they will feed through the roller mechanism on your wide format printing. You just pull this paper backing off when the print comes out of the printer. Other material, such as polyester and cotton, is stiff enough so that it will feed without needing paper backing. We have used both kinds successfully in our Hewlett-Packard 2800 and 5000 printers. Global Imaging Inc, www.globalimaginginc.com handles all HP Designjet printers in case you wish to go this direction.

We have undertaken basic research for the preparation of this report on inkjet printing of textiles, but still have years to go, since we also have to cover fine art photography, giclee printing, UV-cured inkjet printing, solvent inkjet technology, scanners, etc. For the textile portion of our research, we have also visited major universities in Europe that work with textiles, including the Technical University of Liberec, north of Prague, south of Dresden. They do only traditional textiles and do not yet seem to have entered inkjet proofing. Two separate but cooperating universities in Gent, Belgium seem to be the most advanced. One has a complete textile testing center, a million-dollar 2-story building with 120 employees. Their associated technical Hochschule has a large and ample facility related to inkjet printing. We hope to include a report on this shortly.

Ancient History: Electrostatic Printing

The old fashioned way was to use an electrostatic printer and then heat transfer from the printed medium onto the textiles. But the electrostatic printers are costly, going out of style, and there is not much new technology in that field. Thus be sure to avoid buying a used Xerox electrostatic printer (or any used printer of outmoded models). Xerox is poorly equipped even to service such older machines. Phoenix went bankrupt so avoid any Phoenix electrostatic printer.

Only one company still makes electrostatic printers, 3M. Although Rastergraphics electrostatic printers are still sold and serviced by Specialty Toner Corporation, it is unlikely that any new machines have been manufactured for over a year. Raster Graphics closed its doors under that name quite a while ago.

The other downside of going the electrostatic route is that you had to heat transfer using another machine. You can't print directly to textile with electrostatic printers; instead you first print to paper, then the image is transferred by a heat process in the other equally expensive machine.

Companies who already have all this equipment (electrostatic printer and heat transfer machine) do an excellent job of producing textiles. The dye sub process results in an acceptable print even using an electrostatic original. Electrostatic printers are not otherwise known for color balance or exquisite quality; they are rated as somewhat less than an old Encad NovaJet Pro, namely a bit less than equivalent to 300 dpi.

Inks for Textiles

Hewlett-Packard printers use their normal inks to print on textiles. Special textile inks are not presently publicly available for HP DesignJet printers.

For other kinds of printers you can get the two or three special inks just for printing on fabrics.

Jacquard acid dye inks

Acid dyes are for protein fibers such as
- silk,
- wool,
- and nylon.

Acid dye is considered best for natural materials (protein) for example, silk and wool. Some sources include nylon, polyamide and polyester. The printed fabric must be steamed and washed to finish the process.

Reactive dyes are for cellulose fibers such as
- cotton,
- rayon,
- linen, etc.

The d-Gen brochure lists cotton, linen, Tencel, silk, and to some degree wool, as acceptable for their reactive dye inks. These are cellulose and protein fibers. Studio fx list only cotton, viscose and linen.

When using inks of this nature you will need to pre-treat the fabrics. Post treatment implies steaming and washing.

You can get reactive dye inks from Yuhan-Kimberly for all Mimaki and Mutoh printers. We did tests of Yuhan-Kimberly JGET Reactive ink, and its colors surpassed all others that we are familiar with previously. Their website is www.dtplink.com; their ink is available worldwide.

Lyson textile inks

Disperse dye inks are for sublimation onto polyester inkjet textiles. When you use acid dye or reactive dye inks you need to steam the prints to fix the color and wash out the excess ink.
Disperse dye means the inks used in dye sublimation. Disperse dyes dye sublimate onto material which is primarily polyester. May also work to sublimate onto nylon. This implies you print onto transfer paper, then move the paper to a separate heater to sublimate onto the textile. FLAAR has an entire separate FLAAR Reports on dye sublimation printing.

Studio fx suggests that under some conditions you can use disperse dye ink on polyamide for flag printing.
nk.

Pigmented textile inks last longer but are not as bright as other textile inks.

Pigmented textile inks are made by DuPont and other companies. So far pigmented textile ink has pros and cons. Advantage is lower price than textile dye ink; does not require as much pre- and post- printing treatment. However heat treatment to fix the fabric may be required.

Downside, however, is lesser color gamut and poor hand of the fabric (it does not feel like it should to the hand).

Pigmented textile inks reportedly work on most textiles (except silk) so is not as picky as acid dye or reactive dye.

ColorSpan offers textile inks for its FabriJet version of the DisplayMaker XII. This printer is no longer made.

DuPontFusion inks


Here is Nicholas in the headquarters of Yuhan-Kimberly in Seoul, Korea

BASF, DuPont, Yuhan-Kimberly and Ciba are three of the companies making inks for textile printing.
Vivid Image Technologies used to offer an innovative pigmented thermal transfer ink for fabrics. “DuraInk” worked with the Epson Stylus 3000 printer. I am not sure they make this any more and the Epson 3000 was a turkey so would not be recommended in any event.

A new nano-pigmented ink is available from Yuhan-Kimberly: UJET NanoColorant, www.dtplink.com. I have visited this company in person and they have an impressive management and personnel for ink chemistry, fabrics, and wide-format printing R&D team.

Main sources of information are the ink company brochures such as CIBA, the specialized institutes in the textile business (some being in North Carolina, the center of traditional textile production in the US), or industry seminar organizers such as IMI. Another of many resources we used to research our discuss of the ink vs materials relationships was Studio Textile Solutions, a French solution provider. For 2007-2008 I am learning more about printing on textiles from the experienced personnel of Yuhan-Kimberly. It is definitely more productive to visit a company headquarters than to try to learn during a hectic trade show at a busy booth.

Every discussion of textile inks is slightly different. Yes, they all list which core materials work best with acid or reactive dye inks, but they often include materials for their inks that are not included for other brands. Part of this is because some places, such as 3P, coat their silk for reactive dye inks, so you don’t have to change back and forth to acid dye. Unfortunately there are no fabric tests to document what difference you get between printing on the same silk with acid dye ink as compared with printing on that same silk coated to work with reactive dye ink.

Sources of inks

Most printer manufacturers or resellers want to lock you into using only their inks. But there are other inks out there. These are called after-market inks. One such company is Bordeaux; there are many others but we know Bordeaux best because of spending an entire week at their R&D facilities, demo room, and ink chemistry factory. Their web site is www.c-m-y-k.com. The best way to judge whether these after-market inks are good is to find another place that is using them successfully.

I have also studied ink chemistry in Novosibirsk, Russia: spent a week at their ink plant and in their headquarters a few kilometers away. They also make UV-curable ink for using with LED curing. You can download these reports on www.wide-format-printers.NET (in the link at the right to free reports).

A new source of ink that we are studying is based on a several day visit to Korea to see the demo room and display room of inkjet-printed fabrics at Yuhan-Kimberly. Our report on their digital textile printer, JJET MC2 will be ready this week. You can download this reports on www.wide-format-printers.NET (in the link at the right to free reports).

The only way to judge whether these after-market inks are okay is to find another place that is using them successfully.

Inkjet Printers for direct printing on textiles

Although you can print on textiles nicely with 600 *dpi*, 300 dpi is rather modest and we do not recommend that. You also need a photo-quality printer. Thus we do not recommend any of the cheaper CAD plotters.

ColorSpan

ColorSpan used to offer a professional textile printer, the **FabriJet**. This prints directly on the textiles with thermal printheads of the same generation as in the HP DesignJet 2800 and 3800. FLAAR has an HP DesignJet 2800 and the quality is nice. The graininess of that 600 dpi generation of printhead is not as much an issue on textiles, since the fibers themselves have a texture which does not always show the dithering pattern as much as would a photo glossy inkjet paper media.

This top of the line ColorSpan printer uses the two kinds of professional textile inks which work in a thermal printhead. These inks are made specifically for printing on fabrics. ColorSpan offers Texta-Chrome dye inks for cotton and silks. There is one kind of ink for specific natural fibers (acid dye ink) and another kind of ink for specific synthetic fibers (reactive dye ink).

These are complex machines and may not be ideal for anyone but an experienced printing company with in-house technical help. A machine of this class really ought to be cleaned and calibrated daily. ColorSpan now offers a free two-day training course for first-time users of its equipment. So now it is possible for an individual, rather than only large companies, to enjoy the quality and speed of a ColorSpan printer. I took this course with another of the FLAAR review editors; we used the DisplayMaker XII, the very similar printer for signs, photos, and fine art, with normal, non-textile inks.

Since FLAAR does not sell printers we do not keep track of prices but I would estimate that a ColorSpan FabriJet costs around $28,000, and up. Budget the necessary maintenance contract costs as well, probably several thousand dollars every year additional.

For print quality the ColorSpan is tops. ColorSpan is one of the few companies to offer 72” width. Of course you can also print 36” and lesser widths on a 72” printer. The fabrics themselves come in various widths. Unfortunately this product did not survive on the marketplace, but possibly you can obtain used ones.

During 2002, ColorSpan Europe offered a commercial production printing press for textiles, the T^3 (T cubed). This sophisticated printer is one-of-a-kind in the sense of having a system for feeding the fabric which frankly looks more sophisticated than any Stork or other regular textile printer.

I would guess that this is no longer available, at least not from ColorSpan.

ColorSpan FabriJet, and above detail of the print

Encad

Encad had one of the first textile printers, the now aged Encad 1500. I would estimate it might have the same manual ink mechanism as all other Encads of this early generation. If so, this original Encad system requires a hand pump sucking system to load the ink lines, a messy technique that wastes time. In the earlier model that we have, you even had to prime the heads by hand. The newer Encad printers, however, prime the heads automatically.

If the Encad textile printers are similar to the Encad NovaJetPro that we have in our studio, they need to be used every few weeks or the ink may dry out causing the heads to clog. We understand that the Encad 700 is more forgiving and will last a month before drying out. Of course, this can happen with most other inkjets as well. The newer Encads may still have other aspects requiring that you clean the entire system by hand at certain intervals.

Changing inks on an older Encad can take several hours and is extremely messy unless you use the dual ink-line system available on the newer models. Last week we had to clean the ink lines and heads on our elderly Encad NovaJetPro; in addition to taking several hours there was ink all over the computer, the tables, the floor, the tech ruined his clothes, and somehow ink splatter even landed on me. Otherwise Encads can be kept going for several years, you can use after-market inks (as long as they do not clog the heads), and it is fair to say that Encad printers have their loyal following.

The advantage of the Encad model 1500 is that it accepts reactive dye textile inks. Although you can use normal inkjet inks to print on inkjet fabrics, some printers such as ColorSpan, Stork, Mimaki, and others can accept two or more special kinds of inks made specifically for printing on textiles. So be sure you know what kind of ink you need to use, as that may determine what printer you need to select.

Encad printing onto textiles

You can also print textiles with the Encad 850, though I don't know if it accepts any textile inks. The textile prints we saw from the Encad NovaJet 850 at DPI 2001 and ISA 2002 tradeshows looked very very nice. The snappiest looking bright est colors on an inkjet textile that I have yet seen were produced on an Encad 850 at the DigiFab booth at ISA 2002. At recent trade shows such as SGIA 2004 and ISA 2005, DigiFab is of course using the Encad NovaJet 1000i. The colors look bright and attractive, showing that it is their RIP and their coatings on their fabrics that make the difference.

Compedo

A German company called, "Compedo" markets ink for printing on textiles with a ColorWings printer utilizing Encad printheads. Their web site is www.compedo.de. I saw their booth at CeBIT 2000 computer trade show in Germany and then again at Photokina trade show 2000. Then I saw them again at CeBIT 2001 and Photokina 2002. I do not know anything else other than their booth showed printing on textiles of all kinds using a wide variety of inkjet printers. They also make their own series of printers. I believe one is a dye sub system; the other may be direct to textiles. The downside is that this printer is not widely available in the USA. But to be sure, check with Petra Pennekamp, e-mail info@compedo.de

At DRUPA 2004 I did not see either Compedo or ColorWings, though the trade show was so large I may have missed it. ColorWings reappeared at FESPA 2005.

Compedo ColorWings

Hewlett-Packard DesignJet

Since the ColorSpan FabriJet uses Hewlett-Packard printheads both with reactive and acid dye textile inks, this demonstrates that such inks will indeed work with thermal printheads. Encad has also demonstrated this with their Lexmark thermal printheads from Lexmark. However HP does not build a special printer nor otherwise facilitate the use of textile inks in its equipment. Thus HP DesignJet printers presently can use only the inks made by HP; these include a highly regarded pigmented UV archival ink favored by artists as well as dye inks for tradeshow displays and other signs which are taken down after a few months so don't need long-term lightfastness.

HP DesignJet printers can print on quite a variety of textiles directly. The DesignJet 2xxx and 3xxx series are so versatile that it can print on many kinds of cloth such as cotton, silk, polyester, even a leather-like media. The capable people from 3P (an inkjet textile company) can provide other ideas on how to do wallpaper. Of course you can also design and print your own curtains with most good inkjet printers. In theory you can do both *cold* or *heat* transfer with an HP printer (printing on transfer paper). However normally you would get better results using a special dye sublimation heat transfer ink in a piezo printhead system. But the HP DesignJets are faster and in many respects the easiest printers to use because they take care of themselves with their own sensors.

Depending on the media you select for your HP DesignJet, they can be steamed, and therefore can be washable (though I have not done it yet, myself). Steaming usually requires a textile steamer. Fortunately, the new generation of inkjet textiles from 3P will pop the colors without a steamer whatsoever. FLAAR does not yet have a steamer so we use 3P fabrics on the HP 5000 to escape the expense of a steamer.

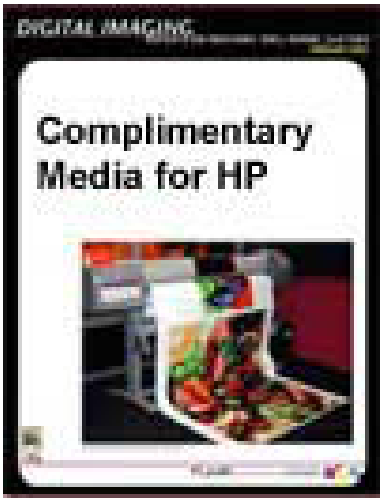
600 dpi is usually enough for textiles. This means you can use the HP 2000, 2500, or 2800 (36") or the HP 3000, 3500, or 3800 (54"). In theory you could try earlier models of HP but the earlier models are made for CAD drawings, not for photographs or comparable images. Other drawbacks of earlier models are the lack of modern RIPs that will run them and the lack of spare parts. The HP 2xxx and 3xxx, however, are fully supported by all current RIP software. We use the HP 2800 but now updated to the better HP 5000ps

To get more information on exotic media that work routinely in the HP DesignJet printers such as the models 2000, 2500, 2800 (all 36") and 3000, 3500, 3800 (all 54") you can also consult the textile vendors: TAL Papers & Films. TAL Papers & Films have fabrics with the appearance of silk, and in some cases, mixed with polyester. The excellent textile media from Kimberly-Clark seems no longer to be available; Sentinel as a company also seems to have disappeared or been absorbed by another company.

Silk and many other textiles are also available from Hewlett-Packard. HP paper-backed fabric and silk is fixable with steam and all work with most HP DesignJet printers. Hewlett-Packard offers textiles such as HP paper-backed fabric polyester 110 gram and HP paper-backed fabric silk satin.

You can steam the results, making it washable. Most media for the HP comes paper-backed. However, we are also aware of other solutions for the HP DesignJet printers that are not paper-backed. I do not know details about this solution though.

HP's large format printers are described on http://www.designjet.hp.com It took us about ten minutes to find the page for HP complimentary media program (for the HP 2000cp series), so now you do not have to fumble around too: http://www.designjet-online.hp.com/HP/DesignJet/news_service_art.html|file_type=text/html&lang=en&document_id=723. We have dragged-and-dropped a relatively complete list of HP's complimentary media on www.large-format-printer.org. (Go to the index, there is a hot link at the bottom of every page, go to media, under media click on HP complimentary media program.)



We have also copied and pasted this HP report into a *FLAAR Report*, titled appropriately HP Complimentary Media. That list is for the 2000, 2500, 2800, 3000, 3500, and 3800 cp series. The HP 500, 800, 1050, 1055, are made for printing CAD, drawings, and an occasional aerial photograph or maps for GIS. Although in theory they will print on textiles, they are not really made for textiles. You will get better images on inkjet textiles with the 2xxx, 3xxx or 5000 series of HP DesignJet printers.

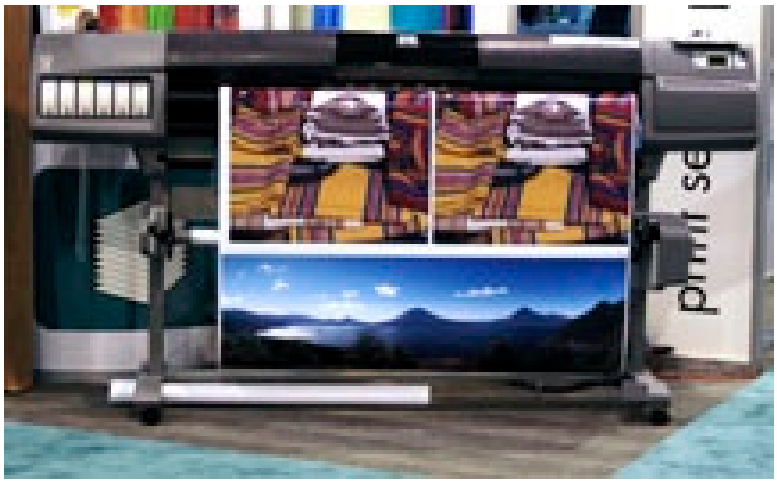
HP5000ps printing with 3P inkjet fabrics

The 5000 and almost identical 5500 use different inks and/or printheads than the earlier 2x00cp and 3x00 cp series and hence require distinct media. The UV pigmented inks of the HP 5000 also prefer specific media. So something that looks wonderful on an older HP printer may not look the same at all with the newer inks (the newer inks are much better but require an inkjet coating made specifically for them). Also recognize that media which works with dye inks may not be intended to work with pigmented inks. We do not recommend using "universal media" unless you know someone else who is using it successfully. You are likely to get better color gamut and more lightfastness if you use a dedicated media made specifically for your ink-printhead make and model.

HP DesignJet printers are considerably faster than any piezo head printer such as Mutoh, Epson, Mimaki, or Roland, which are among the slowest of all inkjet printers due to their *piezo* head design. With a piezo printer at full resolution it can take up to an hour to do a 36 x 42" print or several hours for one single print at banner size. The higher speeds claimed for piezo electric printhead systems (Epson printheads) in advertisements are a myth. To achieve the higher speeds on a piezo system the ink sprays less ink as it sort of skips spaces to jump ahead faster. The results at the less slow settings may appear splotchy, have banding, or appear unfinished, as you would expect for a draft. Such prints are unusable and certainly no one would want to buy one.

The current textile printer from HP is their DesignJet 5500 and 5500PS, a minor update to the 5000 series presented in September 2000. They print at a resolution of 1200 x 600 dpi with six colors. We got a report from a person who took a sample printed on the new HP 5000, with dye based inks. He placed the print (a photo on normal inkjet media) in the full California sun, day after day. He said the ballpoint pen notes on the print faded after three days and that after five days he stopped the test because there was no noticeable fading whatsoever on the HP color print. However it is to be expected that dye inks will indeed gradually fade and that after six months you will wish to re-print (or use pigmented inks, in which case the image will last for years).

So if you want longevity, speed, and photo-realistic quality, consider the HP 5000 or 5500, available at 1200 dpi with six color splendor. Whereas Canon makes nice printers we don't hear a peep about them printing on textiles.



HP5500 at GOA tradeshow 2003

Hewlett-Packard offers three textiles specifically for their DesignJet 5000 and 5500:

HP fabric, cotton matte 190 gram
HP paper-backed polyester fabric, 110 gram
HP paper-backed silk satin fabric.

The specs I have so far do not indicate whether these require steaming to fix the image and pop the colors.

However if you need to do dye sublimation heat transfer, or if you need additional special textile inks, then you need a piezo printhead.

Piezo-Electric Printhead Systems for Printing on Textiles

Printing on textiles is an entire industry unto itself but printers with thermal printheads are among the starting points. Piezo printheads offer the advantage that it is easier to use special textile inks with them.

Epson makes the piezo printheads used by Mimaki, Mutoh, Roland, naturally Epson, some Oce-Gretag printers, and thoseStork printers which are rebranded from Mimaki.

Stork

Stork uses the Konica version of Xaar printheads for its Zircon 8-color piezo printhead printer. Their Zircon-II is now available. We prefer the higher dpi of Epson-type printheads. For industrial use, Spectra printheads tend to have better quality than Xaar printheads. Banding may also be a problem with Xaar heads (as it is also with Epson printheads).

Stork also has its 7-color Mimaki Epson-based piezo printer named Amber. The "regular Mimaki" is the Mimaki Textile Jet, Tx-1600S. There is a new version, the Mimaki Tx2-1600. All versions of this printer use reactive and acid inks. Dispersive and pigmented inks are under development. The advantage of Stork printers is that a company that specializes in printing on textiles markets them. Stork is a European company so you get European precision.

Stork Sapphire is another of their textile models. I do not remember who OEMs that printer (Mimaki is the source for the Amber). The Stork Amethyst uses Herz continuous ink technology, like the old Iris printers.

Stork offers the Amethyst Fixation Unit for steam setting fabrics. Since I have not seen it I can't comment on whether it is a Stork product or rebranded from elsewhere.

I have not seen Stork at many tradeshows in the USA in the last several years. I did not see any USA office listed on their web site. Most indications are that Stork, for basic Mimaki-like textile printers, has shrunk considerably. The new name of the company (what's left) is Stork Prints. There were no textile printers in the shrunken Stork booth at DRUPA 2004. The booth attendant did not have anything to say about inkjet textile printers at all. Either he knew nothing about inkjet fabrics or did not want to talk about the demise of that aspect of Stork. Either way, the booth did not suggest that there is much future in making dedicated inkjet printers for printing on textiles.

Stork printer

Other textile printers

Gretag had a textile printer, the Carolina Press. Gretag Imaging was a major Swiss company and only made high-end equipment for commercial production. This is not the same division as GretagMacbeth (now owned by X-Rite). If you are doing this commercially I guess you can afford those prices, but they are a bit steep for small business, home or hobby use, which is actually the biggest market for inkjet printers for textiles. Gretag sold out to Oce. I am not sure the Carolina Press survived. Several Gretag printers did not do well in the marketplace. The Oce Bellise did not do well; it reportedly had a technology flaw. But other Oce products are perfectly okay.

If you are a smaller or start-up business, you may prefer ease of use of the HP DesignJet.

There is no particular reason why Epson and Roland can't be used to print on textiles. But people seem to prefer to use a Mutoh or Mimaki possibly due to their more robust feeder mechanism. Both Mutoh and Mimaki use the same basic Epson piezo printheads as does the Roland.

Perhaps the Epson reputation for fast fade inks discourages users also. Tests by a trade magazine two years ago of an Epson print (Epson 7000 and Epson 9000 dye inks) documented the Epson inks faded within the first day! Our own tests documented that Epson inks from their desktop printers faded inside even when no sunlight entered the room and the lights were UV shielded! Today (autumn 2005) newer Epson inks strive to overcome the shortcomings of their previous inks.

Konica's Nassenger KS-1600 II, 8 colors, for disperse or reactive-dye inks. It is unknown whether this textile printer is a resurrection of the Iguazu or what. It is not known whether this version of the Nassenger printer is finished either; Konica showed the Iguazu for two years before canceling it. There is another larger model of Nassenger , the Nassenger V, that is industrial strength and not the Iguazu.

Mimaki dedicated textile printers

Mimaki makes several printers capable of printing on inkjet textiles. Their best known textile printer is the Tx 1600s with

Mimaki Textile Jet printer at ISA trade show

seven inks. This is the original for one of the rebranded Stork printers. The Mimaki Tx 1600s can work with either reactive ink or acid ink for textiles. FLAAR just received this model of textile printer.

The 1600s was the workhorse of SOHO and start-ups for years. Now it has been replaced by the Mimaki Textile Jet Tx2-1600, with 8 ink lines and a host of other improvements. The advantage of the Mimaki textile printers is that you don't need paper backing on your fabrics. The Tx2 has an optional dryer.

FLAAR also has a Mimaki JV4, We originally had this loaded with six acid dye inks in one set of its ink lines, and concurrently six reactive dye inks in its other side. This remarkable printer can hold a total of 12 inks (but uses just six at a time). The difference is that cloth for the JV4 has to be either stiff enough to feed on its own, or if open weave, has to have a paper backing to help it feed properly.

In distinction the Tx models can handle unbacked fabrics more easily. To learn more about the Tx and the Tx2 we recommend you ask directly.

Mimaki has a T-shirt printer and their DM2-1810, a flatbed textile printer. It is a modest 180 dpi, four colors, eight heads. It prints 1.86 m by 1 meter. It can also print on cardboard, though 180 dpi is a tad weak.

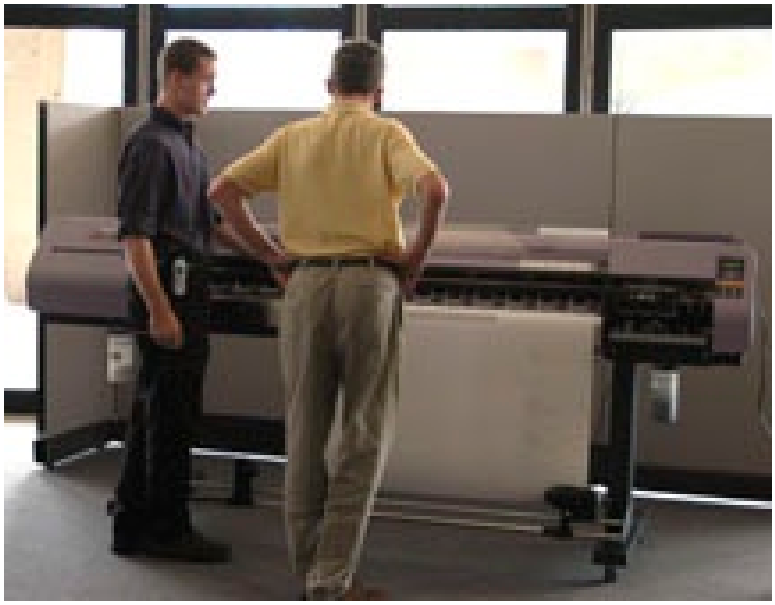
Mimaki now has newer model textile printer, new since about 2004. We will be updating this report shortly.

Other Mimaki printers which can handle textiles

Another Mimaki is their JF series flatbed printers. Since we do not have one of these innovative flatbed printers we can't say much more about it other than that at tradeshows the output looks impressive.

The Mimaki JV4 is a model we have. Very impressive engineering, as you would expect from a leading Japanese company.

We selected the Mimaki over Roland or Epson due to its versatility: this printer can handle disperse dye inks for dye sublimation, acid dye and reactive dye for textiles, plus regular dye or aqueous pigmented inks for fine art giclée. The printer has two complete sets of six-ink receptacles, so you can have two sets of inks loaded at all times. That is not possible with any Roland or Mutoh and with an Epson you can't change inks at all.



Mimaki JV4 being installed at FLAAR-BGSU facilities

Since Mutoh did not upgrade their printers during 2001 Improved Technologies switched to Mimaki. If you want a serious textile printer that is versatile enough also to print fine art giclee or even thick and rigid materials, consider this Mimaki JV4. This printer can also handle dye sublimation inks for subsequent heat transfer. This Mimaki printer has two sets of six colors (so total of 12 ink lines). As typical of most Mimaki printers this versatile system can handle dye sublimation and textile inks in addition to regular dye and pigmented inks.

This Mimaki printer uses the same new piezo printhead technology as the Epson 10000. That means you get the same outstanding quality of the Epson 10000, but faster (due to dual parallel printhead system of the Mimaki's 12-ink construction.

Mimaki JF 604 flatbed printer

Mimaki also offers special software which is useful for textile design and production. Indeed Mimaki also has developed a n add-on dryer unit.

There is nothing more nerving than being a beta-tester for someone else's novel printer design. With a Mimaki you have a mature technology. Reportedly more than 3,000 of this printer are in use around the world.

Mutoh

Mutoh has adapted a Falcon II and turned it into the Viper and Viper Textile printers. SIP trade magazine (4/2005, p. 68) lists Tschudi Technology GmbH in Switzerland as an OEM (www.tschuditechnology.com). I have not seen them listed elsewhere: Mutoh Europe simply exhibits them.

In the US the Mutoh textile printer that tends to be exhibited is called the Mutoh Viper DTS Printer. DTS stands for Digital Transfer Series. Digital transfer means dye sublimation, printing onto transfer paper. So you must have a rotary transfer press to finish the sublimation.

UJET MC2 from Yuhan-Kimberly

During December 2007 it was possible to visit the R&D department, demo room, and test the UJET MC2 from Yuhan-Kimberly. I was most impressed by the bright colors of their reactive textile inks: these are brighter than inks I have seen anywhere else. Kimberly is the same as Kimberly Clark, of Kleenex fame worldwide (so it's a well-funded company who can afford a competent R&D department).

FLAAR will be issuing a separate report on this UJET MC2 printer by next week. This new report will be available at no cost from www.wide-format-printers.org and also from www.wide-format-printers.NET.

Sample made in Yuhan-Kimberly

Demo room, Yuhan Kimberly textile printer

Samples made in Yuhan Kimberly textile printer

Samples made in Yuhan Kimberly textile printer

Italian retrofitting of Roland printers for textiles

More than six different brands exist where companies have taken Roland, Mimaki, or Mutoh printers, and have retrofitted them to handle fabrics. We will gradually add coverage of these. Roland itself has allied with one of these companies; the other companies use Roland printers but are not officially allied with Roland itself.

Industrial Inkjet Textile Printers

The DuPont Artistri, DPS 65 with Aprion technology, Toshin ImageProofer, Zimmer ChromoTex, a new textile printer from Gandinnovations, NUR, and two dual-solvent ink switchover systems (from VUTEk and from HP Scitex) are all industrial priced printers. I would perhaps add the Italian retrofitting of a ColorSpan FabriJet as the T^3 (Tcubed). There is a separate FLAAR Report on the VUTEk textile printer that uses solvent-based textile inks.

Some grand format textile printers are only prototypes; few are actually finished products that function after the technician walks out the door with your check for $300,000+.

Several years ago Canon evidently made at least two prototype textile printers (at a cost of reportedly about a million dollars each one). This prototype never made it into serious production. We have no other information about this printer whatsoever.

In distinction the printers in the 60" to 72" range (Mimaki, ColorSpan FabriJet, T^3), all appear to function.

Digital Printing Systems (DPS) makes their model DPS65. This is a piezo printer with technology from Aprion, roll to roll, and prints 600 dpi. DPS also offers the DPS75T, which is a continuous inkjet, capable of 72" sheetfed (48" x 74"), and is a textile design proofer, via Jemtex.

DuPont

The DuPont Artistri now replaces the DuPont 3210 (the one made by VUTEk). The DuPont Artistri is made by Ichinose, not manufactured by DuPont either. DuPont has all their printers; UV, solvent, and textile printers, contract-manufactured. DuPont is an ink company and a distributor; not itself a machine manufacturer. Their printers for textiles are manufactured by a completely different company than the manufacturer of their solvent or UV-cured ink printers. The division of DuPont which handles textile inks is also different than the DuPont division that handles UV-curable inks. They two divisions don't even exhibit in the same booth. Sometimes one, sometimes the other, are at any given inkjet printer trade show. I last saw the DuPont Artistri at VisCom Milan 2005, and earlier at Print '05, where it had a major booth dedicated to it.

The Artistri 2020 uses Seiko printheads, one of the few printers in the world that uses these printheads (not even Seiko itself uses their own printhead; Seiko uses KonicaMinolta printheads).

The Artistri is a serious production machine with a corresponding price. DuPont has one of the more honest brochures that reveals all the other equipment that you need when you think of buying one of their machines. This is a double-sided sheet with a Workflow, an equipment workflow. It pictures and identifies on one side, with a workflow diagram, every machine you will need to prepare your fabrics and to finish your fabric. Their printer is in the middle.

Virtually no other printer manufacturer is so open, clear, and honest about telling you, in advance, what it takes to make their machine produce the output that they state it can produce. Indeed most manufacturers of eco-solvent printers specifically mislead you, claiming innocently, in writing, that "you don't need lamination." But in the real world their printers do require lamination for many jobs.

For textile printing you need pre-treatment of the fabrics. You need a steamer and/or a dye sub heat transfer machine

(calendering machine). And often you need a washer and dryer.

Overall, when you get a full collection of DuPont Artistri literature, you have abundant information. The brochures do not smoother you with smoke and mirrors as do the literature of other inkjet printer companies at trade shows.

The VUTEk/DuPont 3210 was intended to produce fabrics for home furnishings. The DuPont Artistri is for two broad purposes: short run production of fabrics for apparel, and fabrics for soft signage.

DuPont, being an ink company, offered

- Acid dye ink
- Reactive dye ink
- Disperse dye (due sub)
- Pigmented textile inks

One brochure says that each ink is available in up to 12 colors, but the separate 7color chart does not show 12 samples for each color. The printhead carriages are unique: there are two completely separate carriages: one across the front; one further back (the platen design is as though it were a flatbed. With this system you can have one kind of ink in one carriage and a completely different kind of ink in the other.

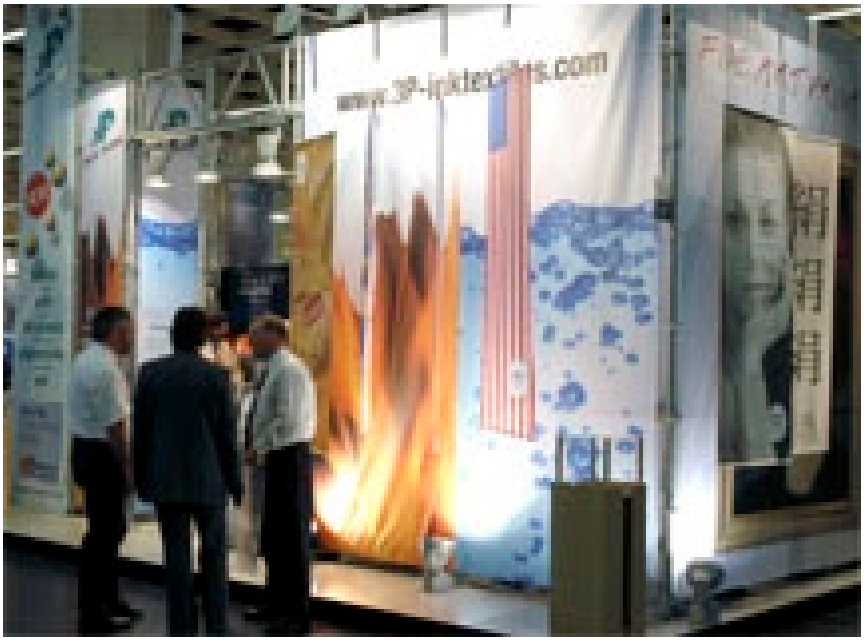
On, in theory, you could load both carriages with the same ink and print twice as fast. The software and hardware to coordinate two totally difference carriages to print without noticeable banding is unprecedented. We would need to undertake a site-visit case study to see the results.

Two different RIPs are available: a textile RIP or ColorBurst. ColorBurst is the official RIP for all printers manufactured by VUTEk.

DuPont dropped out of the wide-format printer market during 2007, both UV and surprisingly seems also to have abandoned offering printer hardware for textile printing.

Leggett & Platt Digital Technologies now offers a giant machine, the Virtu. It is very impressive because the printer was designed from scratch rather than being an adaptation attempting to make a regular inkjet do textiles. Models offer 7.5" to 11.5" widths, has piezo technology, eight printheads, 720 dpi, and is relatively fast. Cost is about $700,000+. This is one of the larger textile printers that favors UV-cured inks.

I have seen very handsome prints on textiles at **ColorWings Compedo** booth at DRUPA 2000 and CeBIT 2000, 2001 tradeshows in Germany. Their brochures have to be about the most honest of any in the world: "…there is a clear chance for unexpected printer cartridge failure…Therefore we recommend for this type of production that, in advance, this fact is taken into consideration in the price calculation." If I remember correctly they were using older generation Lexmark printheads, the kind used in early Encad printers.



At Photokina 2002 the 300 dpi model of Compedo printers with Encad-Lexmark printheads appeared as a finished functioning model. But by DRUPA 2004 this company was no longer exhibiting its printers. Compedo still exists and still sells ink, but we do not know to what degree they and ColorWings have survived (though if I remember, at least one of their staff appeared at FESPA 2005 in a small booth).

Konica Minolta uses Konica printheads in their industrial Nassenger V textile printer. Konica printheads are licensed from Xaar, as are heads from Toshiba Tec, Agfa, and Seiko. But each head is a different structure and a different image quality.

Scitex Vision, together with Reggiani Macchine S.p.A., has introduced their DReAM, one of the first true production inkjet printers. The DreAM uses Aprion printhead technology. HP bought Scitex Vision in August 2005.

Since most textiles are no longer printed in the US, and since Italy is a center for customized textile printing, some textile printers are shown only at European trade shows. So I have never seen the Monna Lisa printer from F. lli **Robustelli** Srl, outside of a leading German trade magazine, SIP (4/2005, p. 70). Yes, they spell it with two n's, Monna. This is one of the few industrial textile printers that uses Epson printheads.

If you consider floor mats as textiles, then you should include the unique industrial inkjet printers of **Zimmer**, www.zimmer-austria.com. These printers are occasionally exhibited at American trade shows. Their quality has gotten much better in the last year. There are at least two models, ChromoJet-KP and ChromoJet-TS. It was the TS that I saw during 2005.

FLAAR has a separate report available on the Zimmer printer.

The 2004 IMI conference on inkjet printing of textiles introduced several other industrial inkjet textile printers. We attended two of these educational conferences, indeed gave a presentation at the second one. Textile printing continued to advance in 2005, with FESPA trade show in Munich being the highpoint.

Steaming and Setting the Colors When Printing Directly

If you print directly onto paper-backed textiles with a normal printer you may need to steam or otherwise set the colors. Be sure you contact a company, which has experience in this, if you intend to print textiles commercially. We recommend you contact Thomas Poetz at 3P Inkjet Textiles. He is independent of all the printer and *steamer* companies so he can provide reliable comparative information free from any vested interest in hardware or software (yes, you may prefer a RIP that can handle printing on textiles). 3P InkJet Textiles offers textiles for virtually any and every printer, which is why he knows all the makes and models inside and out. Contact by email at ThomasPoetz@3P-Inktextiles.com.

All of the textiles from 3P that we used in our HP 5000 came out okay without steaming. However, if you use most kinds of special textile ink (which do not currently work in the HP Designjet printers) you need to steam the fabric to set the colors and to make the colors pop and turn more brilliant.

Generally, there are two kinds of steamers. There are expensive steamers that use pressure and there are less costly steamers that do not use pressure. If you are a home or hobby person, then it is unlikely you can afford to spend more for the steamer than you did already for your printer. The most economical (non-pressure) steamer is available from 3P.

We have heard mixed comments on whether you can fix the inkjet textiles with steam heat alone (economy steamer from 3P), or whether you also need the pressure (Jacquard pressure steamer). I believe you can now also obtain steamers from DigiFab. Jacquard has seemingly downsized in the last 18 months, due to personnel change at management level.

Staedtler inks

The only way to know the answer for sure is to test both of them. Hence the 3P steamer is the one we are evaluating now. As soon as we can put it through its paces we will report on the results.

Rimslow Machinery makes the Steam-X 1850 and Steamex 450 steamers. You attach either to your printer so you can continuously

print and steam all in one operation. This is essential for commercial production of inkjet textiles, but is not something for home or hobby use.

Washer and Dryer for finishing your inkjet textiles

In many instances you will need to wash your textiles to get out the excess ink. This implies drying them too. Any washer and dryer are fine, but front-loaded industrial units are obviously preferred.

Dye Sublimation and Heat Transfer

Sublimation is a rather complex chemical process requiring considerable experience and dedication. As you may have already found out, Sawgrass is the big name in this field. However, there are other systems considered more economical.

You can use many piezo printers to do dye sublimation printing. The Epson 4000, 7600 or 9600 would be better than the Epson 7500, 7600, 9500, 9600, and 10000.

That is because those earlier printers accept only one kind of ink…Epson ink.

A company which makes heat transfer equipment is www.rollosystems.com

If you need a heat transfer system, consider the HeatJet wide format. With the HeatJet you can prepare curtains, flags, banners, trade show signs and everything else.
Also checkout Spectrafusion inkjet transfer media from Sihl. You will need a heat press or a laminator that can achieve almost 300 degrees F.

NUR now offers a dye sublimation grand format printer for inkjet textiles. The NUR FabriGraph goes up to 126 inches wide. Prices are $180,000 to $ 350,000, depending on size.

The Mimaki JV4, in distinction, sells for about $30,000.

I hope that takes care of getting you started with some tips and leads. We will have more information in our FLAAR Report dedicated to dye sublimation.

You can also use a normal inkjet printer to do straight inkjet image transfer. This uses regular inkjet inks (no dye sub inks required). This means you could try this out with any inkjet printer such as Encad, Hewlett-Packard or Mimaki.

Textiles and Fabric to Print On

Dozens of different textiles are available for use with inkjet printers. Which material you use depends on:

What inks are in your printer?

- Normal dye inks or normal pigmented inks
- Textile inks
- Textile inks for natural fibers:
- Textile inks for artificial fibers:
- Ink for dye sub heat transfer via paper
- UV-curable inks
- Solvent inks

Canvas is in one sense a textile (cotton) but is usually included with fine art media

Cotton in a wide variety of forms (ask for the FLAAR Report on inkjet media for either signs or photo-realistic or fine-art: they all include more information on inkjet textile media)

Translucent Dacron

Polyester, comes in many forms, such as inkjet coated on both sides.
Silk is a popular fabric for inkjet printing.

3P, Jacquard, DigiFab, Fisher Textiles, and a dozen other companies around the world offer textiles for inkjet printers. Kirshenbaum offers a warp knitted polyester fabric that looks nice and bright: www.kirshenbaumlinings.com. They exhibited at FESPA 2005.

The HP DesignJet series of printers does a nice job printing on canvas as long as it is not too thick. Artist's print canvas is made by Fredrix. Cut sheets and rolls are available for fine art giclee printing. They also offer TaraGlo, fluorescent colored paper. I do not yet know if this works in inkjet printers, but sounds like an interesting specialty paper. You can get artist's canvas at Improved Technologies.

You can make curtains, bedspreads, tablecloths, wall hangings, murals, and all kinds of impressive decorations with inkjet fabrics. Polyester is a great material for trade show display because you can roll it and unroll it and you do not get blemishes in the surface.

Just try handling a photo-glossy print at the size of a trade show graphic. It will get dented, nicked, and otherwise blemished in a matter of minutes. Textiles are much more forgiving of being handled.

Plus you have the element of surprise. Few people realize that you can print murals on fabrics. Yes, the appearance is muted compared to photo glossy, but sometimes the textile surface evokes a more natural environmentally friendly sense. Photo glossy can sometimes look a bit plastic.

Overall, we get more response from people who see a mural-sized image on a textile than if the same image is printed on paper.

The above tips can get you further along in your search for information because now you know which people to contact. We have included the emails of those people whose companies we know and trust.

Once you actually have your new printer in-house, you may gradually wish for additional information about what paper to feed your new machine, about what inks are best for various purposes, and about laminating equipment. Thus, we are working out a program to follow up with news tips from the pertinent companies to send out later this year. Since I am a photographer myself, I too am always looking for cost-effective, new products. But since I do not have a room full of secretaries to handle all this, usually it is easier to ask the hardware or software company if they can help out and forward you the information themselves.

Colorfastness

Please note we are not in a position to offer any information on how often you can wash a color-transferred fabric. This is in part because the factors vary so much. For example, the washing machines in Europe use a completely different kind of system than in the United States; not many of my American garments last long in European washers.

UV-curable Inkjet Printers for Textiles

At a recent IMI conference, a leading specialist on inkjet textiles predicted that UV-cured printers would not be a major factor in printing textiles. But this prophecy is not correct. We interviewed the owner of two ColorSpan 72UVR printers; he stated that the ability to print UV inks on textiles was one of several reasons why he was so happy with his UV printers. And the new Durst Rho 350R specifically lists textiles as one of the class of materials that this printer is good at:

- Polyester
- Canvas
- Cotton
- Synthetic silk
- Banner materials
- etc

Further Information

A good article on both direct digital printing on textiles as well as dye sub transfer to textiles is in the Nov/Dec 1999 issue of the Big Picture magazine, www.bigpicture.net (ST Publications). This is a lengthy article by a knowledgeable writer. This issue has a second article that covers more of the dye sub aspects. Overall, this issue is about the best coverage of the subject that is available.

Conferences on inkjet textiles

www.imaging.org offers seminars on highly technical subjects.

For several years we attended the Annual Digital Printing of Textiles Conference, organized by the Information Management Institute, Inc (IMI). This was professionally organized, had experts as speakers, and was overall the most informative conference I have attended so far that year. We recently attended the ’02 version in Palm Springs. As you can note, FLAAR works hard doing research so we can update these reports for you.

IMI organizes conferences on inkjet printing on textiles every year. Typical industry conferences are at resort hotels: nice swimming pool and golf, but no actual inkjet printers.

You can reach them by phone at: 207-235-2225 or by email at imi@imiconf.com. Their initial web site is: http://imi.maine.com/textile01.html. Their new web site is www.imiconf.com.

The above tips can get you further along in your search for information because now you know which people to contact. We have included the e-mails of those people whose companies we know and trust.

FLAAR would like to partner with other universities, institutes, or industry associations to host conferences and workshops. Our advantage is that we have several printers capable of printing on textiles.

Upcoming Evaluations

FLAAR was affiliated with the Center for Applied Technology at Bowling Green State University in Ohio for seven years. Now that we have a steamer from 3P we have more success in finishing the printed materials. Still it has been tough to raise some interest on campus in inkjet printing on textiles. A professor at a neighboring university expressed an interest in our textile printer, so we have moved this printer to her university.

Glossary of Terms

A far more complete glossary is in a separate FLAAR Report

Updating these glossaries is an on-going work. Thus not all terms are defined in this edition. Their definitions will be added in subsequent updates. We are currently updating more than thirty of the now over 50 FLAAR Reports so it takes a while.

acid dye textile ink: one of three special inks for inkjet textiles. Acid dyes are for synthetic materials such as lycra, nylon, spandex, as well as natural silk, wool, and leather. See also disperse inks and reactive inks**.**

banding Bands of discrete color or tone that appear when a laser printer cannot reproduce a smooth graduation from one color to another. Instead there are noticeable jumps between one value and the next. Banding on inkjet is more complex; several kinds of banding may occur in wide format output. It is generally stated that most (but not all) banding results from clogged nozzles, especially on piezo printheads and notably on some Roland printers. Banding is most noticeable in areas of cyan or blue (such as the sky) or across dark solid colors. Banding may be worst in human environments and on certain media. Dr Ray Work indicates another source of banding in piezo printheads is air bubbles inside the printhead. He notes that any open ink system can allow nitrogen to get into the ink. Considering that he is the developer of DuPont chemical company's inkjet ink program, he definitely knows printhead technology inside out. For more information on which printers are most prone to banding defects, see the FLAAR Report entitled: *"Piezo vs Thermal."*

disperse dye inks are for dye sublimation onto polyester inkjet textiles. See also acid dye ink and reactive dye inks.

dpi (dots per inch) A measure of the output resolution produced by printers, imagesetters, or monitors. Dpi in the images themselves is actually ppi, pixels per inch since of course there are no dots in an image on a monitor.

inkjet A printer technology where ink is splashed onto the printer paper to form an image or character.

media, actually in this case singular and plural. Means any material coated with inkjet receptor powder. 90% of the material you put through an Encad, Epson, or HP is media. Also see substrate. The word media also has many other meanings in digital imaging.

oversaturation Too much ink deposited onto a printed image which leaves the substrate to buckle.

piezo-electric The property of certain crystals that causes them to oscillate when subjected to electrical pressure (voltage).). When the membrane oscillates, this movement forces ink out the nozzle. If you are interested in the specific details, attend the IMI conferences on inkjet technology: for more information write imi@imiconf.com.

pigment Inks While conventional inks are essentially oil-based dyes, pigment inks consist of tiny chunks of solid pigment suspended in a liquid solution. According to their proponents, pigment inks offer richer, deeper colors and have less tendency to run, bleed or feather.

Raster Image Processor (RIP) Produces an image defined as a set of dots/pixels in a column-and-row format. Rasterisation is the process of determining values for the dots/pixels in a rendered image. The placing of ink in a random pattern on a print pleasing to the eye.

reactive dye inks are for cotton, silk, rayon, and wool. See also acid dye inks and disperse dye inks for inkjet textiles. Mimaki Tx2-1600 is one of the few wide format inkjet printers which can take all three of these ink types.

saturation The amount of color in a specific hue.
solvent inks, use aggressive chemical solvents instead of water. Due to environmental and health concerns, some companies have switched to lite solvents. Lite solvents come in several flavors: one is simply less aggressive the other is evidently an oil-based solvent ink (used by Roland SolJet as an example). Best place to learn about the chemical details of all this is from an IMI seminar, described on www.imiconf.com.

steamer, many inkjet textiles need to be steamed, preferably under pressure, in order to set and pop the colors. Best inkjet textile steamer is available from Jacquard.

sublimation-dye process. With wax or thermal ribbons, it is a printing process that uses special media consisting of a printer ribbon, a heated "print head" and laminated printer paper. When the "printer head" passes over the paper, the image is printed by varying the heat and causing color (consisting of cyan, magenta and yellow) dyes to be passed on from the ribbon to the paper. Printers such as Matan and Summa use this, as does the desktop Kodak 8600 series printers.

Another form of Dye Sublimation involves printing with a regular thermal (Encad) or piezo (Epson) printer on transfer paper. Heat press is subsequently applied to the paper on top of the material to which you wish to sublimate. The ink turns into a gas and penetrates the inkjet receptor later of the material. You end up with an image on ceramic tiles, solid metal, etc.

textile steamer, see **steamer**

t**hermal transfer** A printer technology that uses heat to transfer colored dye onto paper. Matan is a wide format printer using this technology. Alps was a desktop sized printer (which went out of business last year).

UV cured inks Pigmented inks which dry instantly upon contact with UV light. More environmentally friendly than solvent inks. UV cured inks are gradually replacing solvent inks in industrial and grand format printers due to new environmental protection laws against solvent inks. Do not confuse these with HP's so-called "UV inks" which are regular water-based pigmented inks. Hewlett-Packard inks from DuPont are not by any means UV cured.

Bibliography

The main bibliography and references cited for the overall FLAAR Information Network and for these FLAAR Reports is itself a separate report available as part of the digital photography course. Additional materials are in the published Proceedings of the IMI conferences on inkjet textiles.

Notes and tidbits garnered from countless sources including RIP/First Quarter, 2001, p. 21, www.dpia.org as well as naturally the web sites of the respective companies and/or their brochures as collected at countless trade shows over the last two years.

Some of the companies that are dedicated to selling printers, RIPs, fabrics, inks or other production hardware or software have brochures, white papers, or documentation that is very helpful. One such booklet we got at FESPA 2005 from a German company, Converter Solutions, outside Berlin, www.converter-solutions.de. Another informative resource is the booklet, also passed out at FESPA 2005, from Studio fx, Digital Textile Solutions, a French company, www.studiofx.fr, www.textilejet.fr.

A good source of constant information on inkjet printing on textiles is available in the German-language trade magazine SIP. One sample is "Reife Technologie auf der Suche nach dem Markt: Ergebnisse des Digital Textile Seminars 2005," *SIP*, 8/2005, pp. 56-59.

Another source of information on digital textile printing is Web Consulting. They have seminars for the digital textile printing industry.

www.aatcc.org/magazine/files/inkjet_aatccreview.pdf
"Ink-Jet Printing…" by Phil Owen, discusses industrial inkjet printing of textiles.

www.arioli.biz/ing/prodotti_i/altri/digit.htm

Commercial industrial grade washer for digitally printed fabrics.

www.avosi.com/html/body_direct%20print.html
Discusses large format printer steaming station.

www.colortextiles.com/faqs.html
FAQs.

www.digitaltextile.net/pages/archive/articles/overview2001.htm
Chris Byrne, Web Consulting.

www.dtplink.com
This is the web site for Yuhan-Kimberly; they offer all four kinds of textile inks.

www.georgeweil.co.uk/pdf/fabric_paints_and_dyes.pdf
Covers mainly painting silk by hand, but some of the information is pertinent to inkjet printing also.

www.lino.gr/news/press/releases/20000228_fabrijet.html
On the FabriJet from ColorSpan.

www.muttonhead.com/fabricfacts.htm
A company offering inkjet fabrics that I have never previously heard about.

www.ntcresearch.org/pdf-rpts/AnRp03/C03-PH01-A3.pdf
"Universal Set of Dyes for Digital Inkjet Textile Printing," Hitoshi Ujiie, Philadelphia University. He is a leading teacher of inkjet textile printing.

www.signweb.com/banner/cont/pressprint5.htm
Learning from experience.

www.spectra-inc.com/spectranews/pdf/news_2001/Textiles_NIP17_Tech_Paper.pdf (Spectra paper on "High Performance Piezo Ink Jet Printheads and Production Printing of Textiles," by Creagh and Baldwin, Spectra, Inc.)

www.techexchange.com/thelibrary/DTP101.html
A primer.

www.textileindustries.com/Past_Issues.htm?CD=20&ID=915
By Teri Ross.

http://textileinfo.com/en/manage/ronten/inkjet/page06.html
Mentions a Mimaki transfer machine, and Konica's Nassenger KS-1600 II. 8 color textile printer.

www.toshin-kogyo.co.jp/en/inkjet/p1.html
Ichinose textile printer on their web site.

Most recently updated January 2008.

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FLAAR Digital Imaging Resource Center

Relationships with other universities and Institutes

Since other universities are dedicated to inkjet printing on textiles, we are open to discussion for joint projects. We have access to textile printers, special RIPs for textiles, inkjet fabrics, and steamers that might be more appropriate being used at or with a university where faculty, graduate students, and undergraduates have inkjet printing on textiles as a major focus.

Follow up

We hope you enjoyed this report. You may notice that we have been going to a lot of trade shows and conferences in order to keep up with the latest hardware, software, and fabrics.

Eventually our staff and especially the students at both our universities will wish to follow-up with you. They are conducting surveys to check on the effectiveness of our educational programs. We are also working at nudging the printer manufacturers into producing printers that will better serve the needs of you, the end-user.

At some point in the future we may send you a survey form. We hope that you will be able to take the time to fill it out, and in this manner to respond to our program of mutual public education.

We can learn from your experiences entering the world of wide format inkjet printing in a similar manner as we hope you have learned from our tips.

We appreciate it when you can tell other people about our web sites and information service. Being non-profit we do no advertising, hence depend on word-of-mouth to let people know. Telling other people in news groups that you belong to or to newsletters, is a good way to return the favor.

How Are Evaluations Accomplished by FLAAR?

The task of an independent evaluator is to be forthright, fair, and helpful. Our notes on the occasional aspects of a product that need improvement can provide an asset to the company giving them the opportunity to improve that weakness and make an even better product. We welcome sponsorship from directly competing companies since our goal is to assist all sides to improve knowledge of wide format digital imaging.

The popularity of FLAAR evaluations is based on five factors:

1. We use end-user reports from other photographers, architects, repro shops, sign shops, and fine art studios who have direct experience with the product in question.

2. We analyze studio photography equipment at the leading trade shows in Germany, Italy and the USA.

3. In past years we undertook our tests in our own facilities but with so many new printers it is more practical to test them in the demo rooms of the manufacturers and/or distributors.

4. FLAAR editors receive training at inkjet conferences and seminars. Printer manufacturers, paper mills, RIP engineers, and other companies also provide additional training for the FLAAR staff. This allows us to learn about the people behind the products.

5. We have received over 57,000 e-mails from end users in recent years. Some of these end-user reports discuss every detail of what their equipment does well and what it does poorly.

Not many trade magazines or web sites have such a wealth of fresh information pouring in every day. As a result, the FLAAR reports offer pertinent, up-to-date, factual data on what to really expect. Our reports are pithy, to the point, penetrating, and expose the pros and cons of each printer.

FLAAR itself is non-profit and headquartered at Bowling Green State University from 2001-2008. FLAAR is negotiating with partners to open a facility in Europe and is also interested in partnering with additional universities and institutes in the US and Asia.

Reality Check

Being at a university absolutely does not mean we know everything. But intellectual curiosity often leads us to enter areas that are new to us. So we do not shirk from entering areas where we are obviously not yet expert. If in your years of wide format printing experience have encountered results different 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, since we are not dependent on sales commissions we can openly list the glitches and defects of those printers that have an occasional problem.

FLAAR and the university have corporate sponsors but FLAAR web sites do not accept advertising, so we don't have to kowtow to resellers or manufacturers. We respect their experience and opinion, but we prefer to utilize our own common sense, our in-house experiences, the results from site-visit case studies, and comments from the more than 49,000 of our many readers who have shared their experiences with us via e-mail (the Survey Forms).

Licensing Information

Update Policy

Starting in 2008, updates on UV-curable wide-format inkjet printers are available for all individuals and companies which have a subscription, or to companies who are research project sponsors. To obtain the next update write ReaderService@FLAAR.org.

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

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

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

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

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.**

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.

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

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

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

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

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

Be aware that trade show results may not be realistic. Trade shows are idealized situations, with full-time tech support to keep things running. The images at a trade show may be tweaked. Other images 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 uni-directional, which may be twice as slow as bi-directional.

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

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

Don't rely on references from the reseller or manufacturer (you will get their pet locations which may be unrealistically gushy): find someone on your own.

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

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 our two universities.

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

Therefore this report does not warranty any product for any quality, performance or fitness for any specific task, since we do not know the situation in which you intend to use the hardware or software. Nor is there any warranty or guarantee that the output of these products will produce salable goods, since we do not know what kind of ink or media you intend to use, nor the needs of your clients.

A further reason that no one can realistically speak for all aspects of any one hardware or software is that each of these products may require additional hardware or software to reach its full potential.

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

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

A Chevy Suburban simply does not have all the bells and whistles of the Cadillac Escalade version of this SUV.

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

Most newer printer models tend to overcome deficiencies of earlier models. It is possible that our comparative comments

point out a glitch in a particular printer that has been taken care of through an improvement in firmware or even an entirely new printer model. So if we point out a deficiency in a particular printer brand, the model you may buy may not exhibit this headache, or your kind of printing may not trigger the problem. Or you may find a work-around.

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

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

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

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

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

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

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

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

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

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

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

yet.

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

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

Acknowledgements

Fortunately the university covers some of the operating costs of FLAAR on their campus. Thus we do not really have much incentive to pocket hush money from producers of lousy products. We feel that the pros and cons of each product speak more than adequately for themselves. Just position the ad claims on the left: put the actual performance results on the right. The unscrupulous hype is fairly evident rather quickly.

With 12 employees the funding has to come from somewhere, so although the universities cover the core expenses, we do welcome project sponsorship, research grants, contributions that facilitate our educational programs, scholarships for co-op interns and graduate students, and comparable project-oriented funding from manufacturers. The benefit for the end-user is a principle called academic freedom, in this case,

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

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

Besides, it does not take any money to see which printers and RIPs function as advertised and which don't. We saw one hyped printer grind to a halt, malfunction, or otherwise publicly display its 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 and for funds to allow us to attend all major international trade shows, which are ideal locations for us to gather information. We thank Drytac, Sun LLC, Bordeaux Digital PrintInk, Mutoh Europe, NUR (now part of HP), IP&I, Dilli, Yuhan-Kimberly, VUTEk and Zund for providing funds so that we can make more of our publications free to end-users. During 2000-2001 we had grants to cover all the costs of our publications, and all FLAAR Reports were free in those early years. As that early grant naturally expired after a few years, we had to begin charging for some of our reports to cover costs. Currently our reports on lamination tips are sponsored by Drytac and our publications on eco-solvent ink printers are sponsored by Mutoh Europe. Now (in 2007), we are seeking corporate sponsorship so we can gradually return to making at least 20% of our publications free to our readers.

It has been helpful when companies make it possible for us to fly to their headquarters so we can inspect their manufacturing facilities, demo rooms, and especially when the companies make their research, engineering and ink chemistry staff available for discussions. When I received my education at Harvard I was taught to have a desire to learn new things. This has guided my entire life and is what led me into wide-format digital imaging technology: it is constantly getting better and there is a lot to learn every month. Thus I actively seek access to improving my understanding of wide format printer technology so that we can better provide information to the approximately quarter-million+ readers of our solvent and UV printer web site (www.large-format printers.org) and the over 350,000+ who read either our wide-format-printers.org site or our roughly half million combined who read our digital-photography.org and www.FineArtGicleePrinters.org sites.

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

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

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

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

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

We really liked some of the results whereas some of the other products were a bit disappointing. Providing samples does not influence the evaluations because the evaluators are students, professors, and staff of Bowling Green State University. These personnel are not hired by any inkjet printer company; they are universities employees (as is also true for Nicholas Hellmuth). The testing person for the HP ColorPro (desktop printer) said he frankly preferred his Epson printer. When we saw the rest results we did not include this 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 two manufacturers of piezo printers (Epson and Mimaki). This is because piezo has definite advantage for some applications; thermal printheads have advantages in different applications. Our reviews have universal appeal precisely because we

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

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

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

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

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

FLAAR also serves as consultants to Fortune 500 companies as well as smaller companies and individuals who seek help on which printers to consider when they need digital imaging hardware and software.
A modest portion of our income comes from our readers who purchase the FLAAR series. All income helps continue our tradition of independent evaluations and reviews of inkjet printers, RIPs, media, and inks.

Most recently updated January 2008.

Text written by Nicholas Hellmuth, FLAAR.

FLAAR Digital Imaging Resource Center

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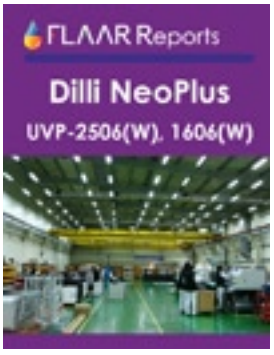

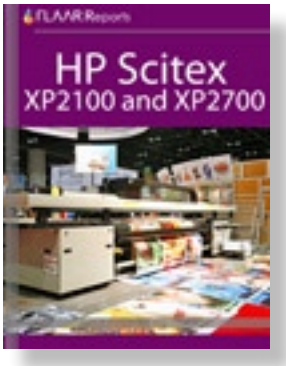

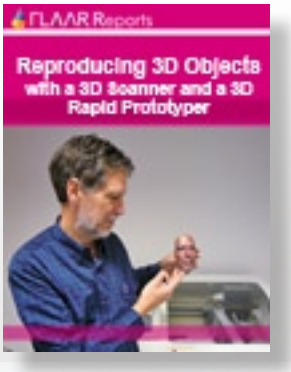

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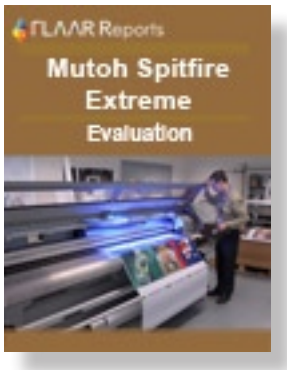
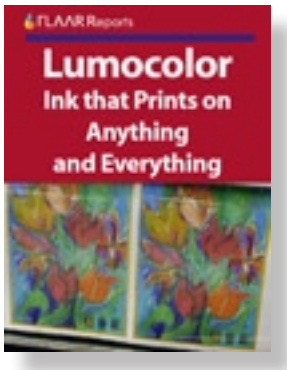
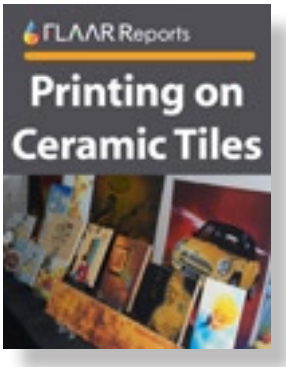
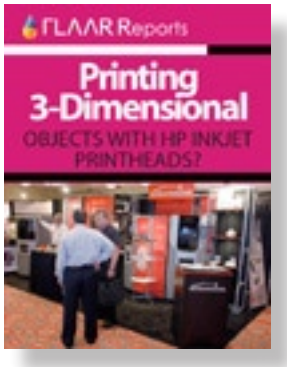
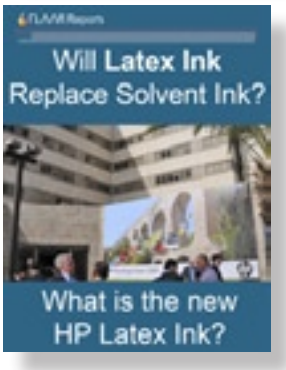
can be obtained at no cost by filling out the Survey-Inquiry Form, which you can find by clicking on the "Access to Survey for Free FLAAR Reports" link on www.wide-format-printers.NET

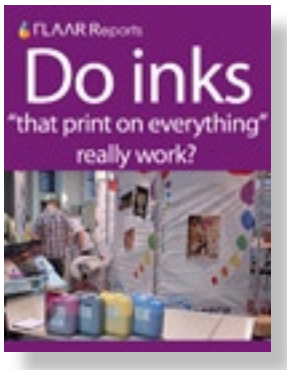












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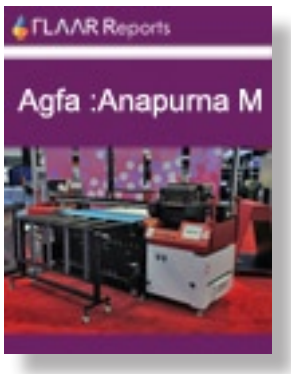

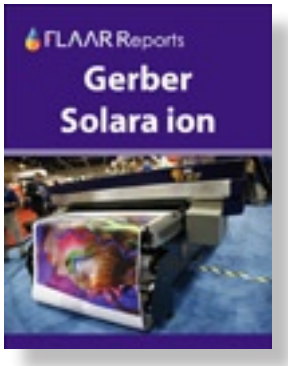

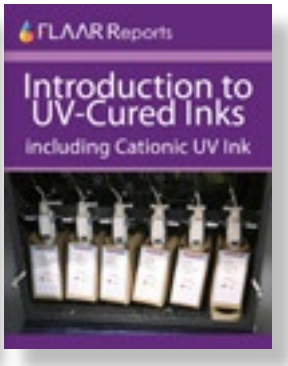

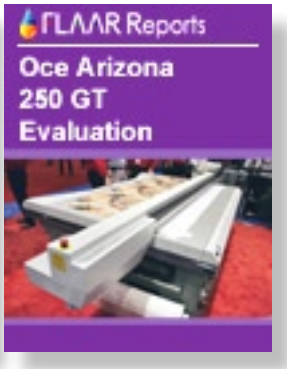

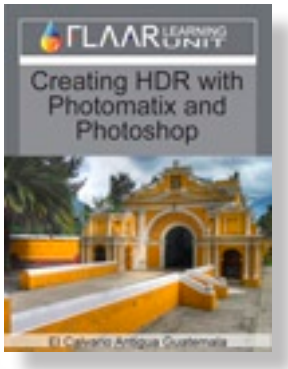

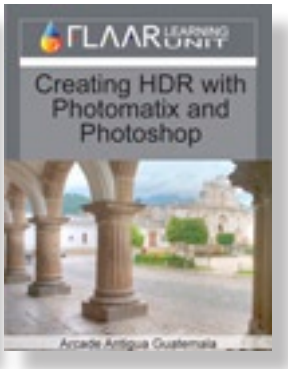

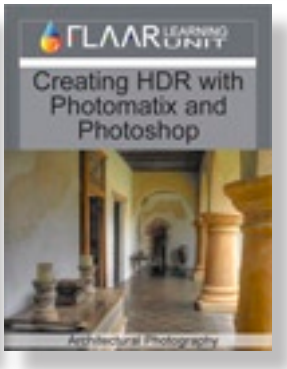

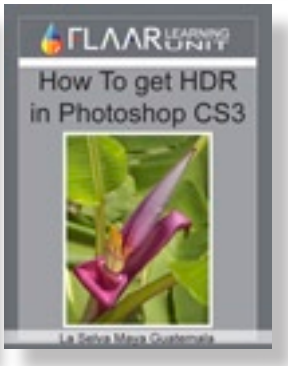

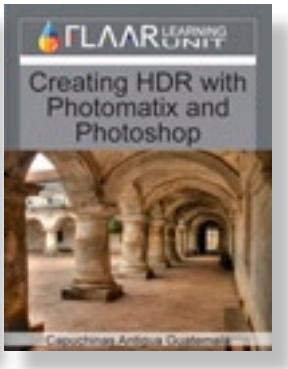

Each month Dr Nicholas Hellmuth travels around the world to investigate and learn more about the new technology.

This site is dedicated to bring you the latest facts on UV-Curable systems, that's why you will find the newest information, if you acquire your Subscription you will have access to these and more FLAAR Reports.

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