



## Eliminate Horizontal Banding Defects? Intelligent Interweaving Technology

Advances from Mutoh that Dramatically Eliminate Banding Defects





Front cover photograph: Mutoh Spitfire

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Ten years ago solvent inkjet printers produced primarily billboards and banners; namely signage that was so far away you could not see the defects.

The typical defects were

- Horizontal banding lines all the way across the image
- Heavy dot pattern
- Mottle (what I call splotchy appearance).
- And the reeking carcinogenic odor and VOCs for which full-strength solvent ink is infamous for.

In 2002, eco-solvent inks were introduced. Although the first two generations had infamous issues widely discussed in user-forums in the Internet, the third generation eco-solvent ink that is available since 2006 is popular among end-users. We have interviewed end-users that have experience with the third-generation eco-solvent inks and they accept it as a viable ink choice. As a result the third-generation eco-solvent ink chemistry has been accepted by FLAAR as a viable chemistry that is capable of well documented quality.

Parallel to the development of eco-solvent inks came the evolution of mild-solvent inks (also called lite-solvent inks or low-solvent inks). Mild-solvent inks are less aggressive than full solvent and hence easier to use when legislation prohibits full solvents (or when you want to protect your health). One example of a successful mild-solvent ink would be the Seiko ColorPainter 64S.

For the last ten years FLAAR, an independent research and educational institute, has dedicated itself to the evaluation and reviews primarily of wide-format inkjet printers that are capable of producing high quality images. To be blunt, if a print is good enough quality to hang in a museum exhibit, then this is the quality we are interested in working with.

In the past solvent ink printing machines produced too much banding, splotchiness, and unbearable odor. So our evaluation and FLAAR Reports publication programs were primarily on Epson, Canon, HP and water-based Mimaki, Mutoh, and Roland. Recently we have spent several years covering UV-curable inkjet flatbed printer technology. But for 2007 we are devoting our energies and experience to looking at the new technology and ink chemistries that are evolving in eco-solvent and mild-solvent.

One of the first aspects of our new program in publication education on solvent inkjet printers is about a new breakthrough in eco- and mild-solvent wide-format printer technology. Mutoh Europe was able to utilize a previous breakthrough from Mutoh Japan and expand its capabilities to a second generation solution. In early 2007 it was possible to experience this new technology at the Belgium headquarters of Mutoh Europe during one entire week at the main factory demo room and adjacent test facilities.



*Mutoh Europe Headquarters 2007*

**This new FLAAR Report on Intelligent Interweaving**

For the past ten years horizontal banding has been a perpetual headache for inkjet printers. Roland had significant issues with banding from 2000 through 2003. Their printers have improved since then but banding still pops up. Banding plagues all printer brands and models at one time or another, especially with industrial printheads used in solvent and UV-cured kinds of printing. Why?

Banding can be caused by a many reasons, some of which include:

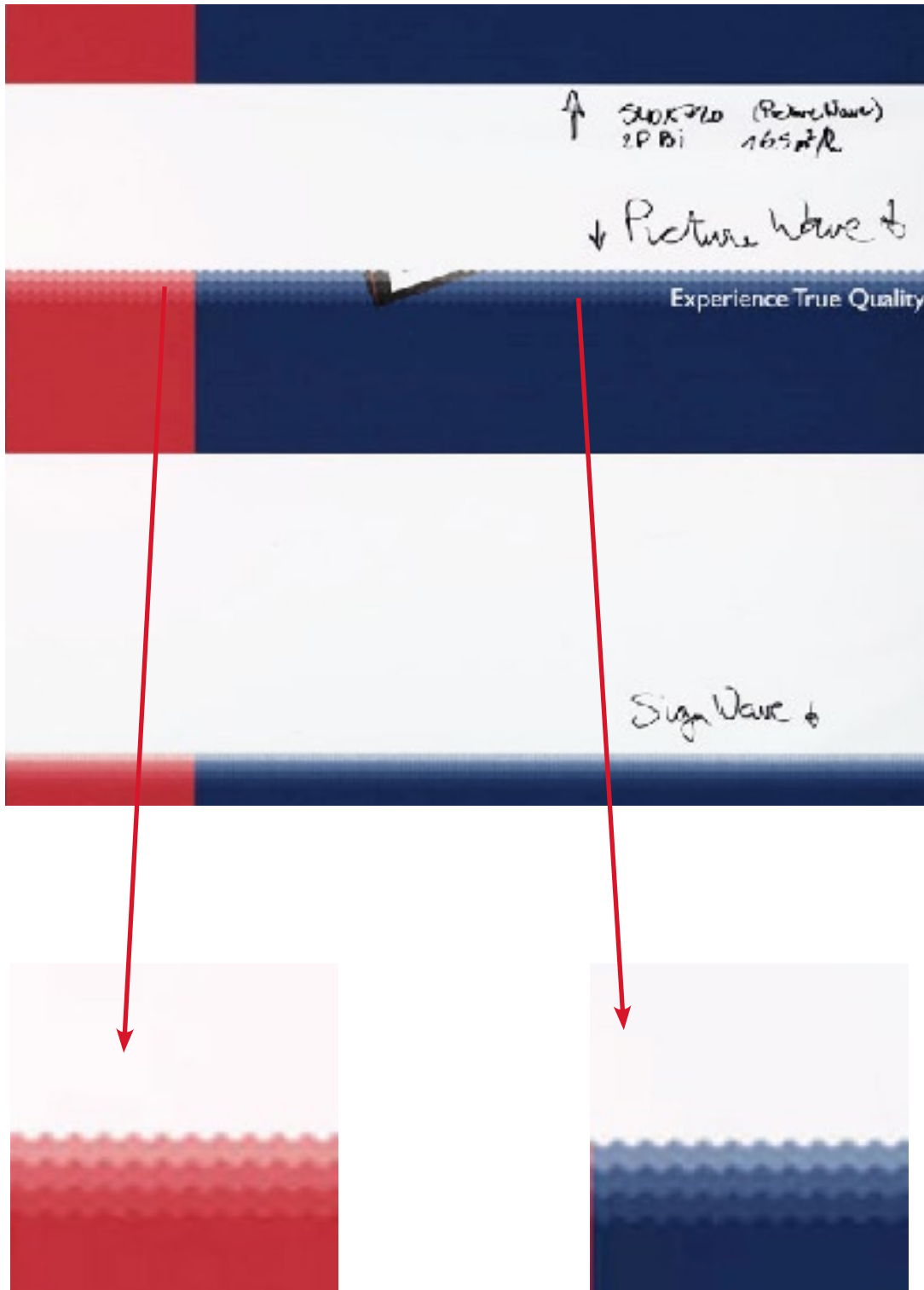
- A blocked nozzle or a nozzle that is otherwise dead
- A deflected nozzle that fires in the wrong angle
- When the ink lines and printhead become contaminated by air
- If the heater(s) are set too high.
- When the media feeds incorrectly.

If the media feeds too fast, it leaves a white line.

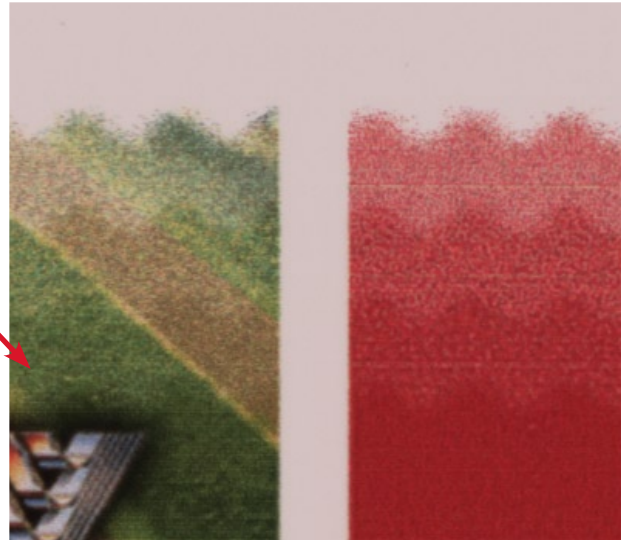
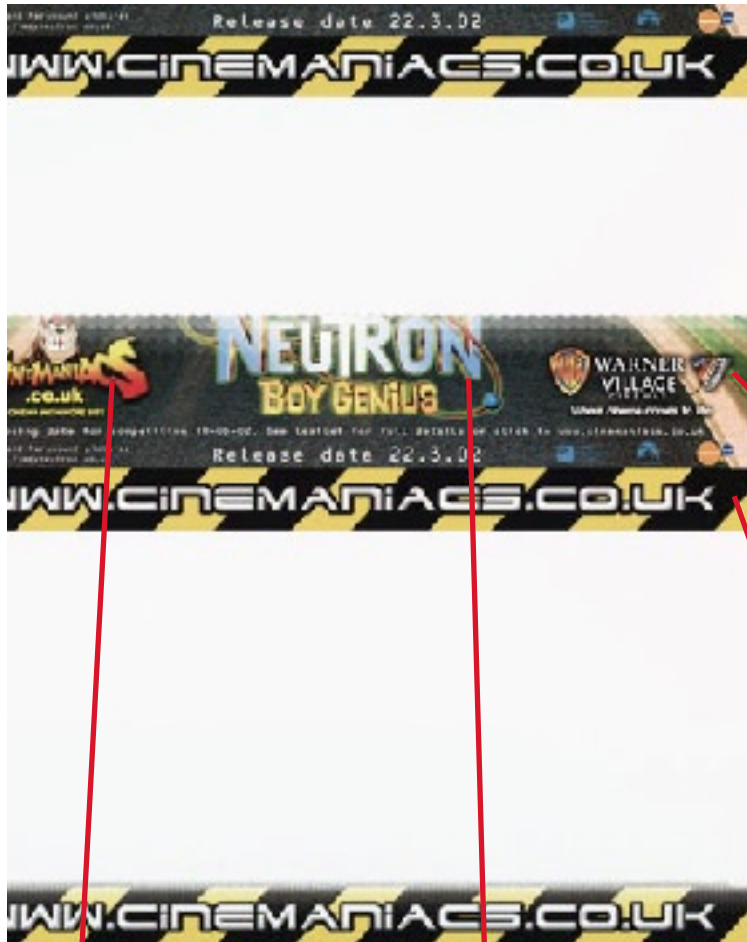
If the media feeds not far enough, then the new printing path overlaps and prints on top of the previous printing path. This leaves a dark line across the print. These banding lines form a regular pattern, so they are painfully evident.



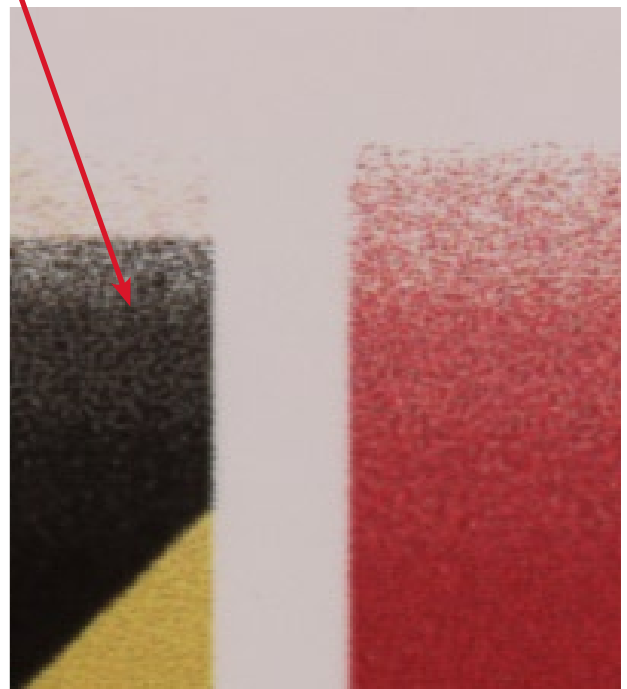
*Banding*



*These are closeups of the Intelligent Interweaving in action. If you are a computer whiz, and a Nobel Prize in software, you could try to figure it out, but we are not ourselves into the business of reverse engineering anything, so for us what counts is that it works, well, and quickly.*

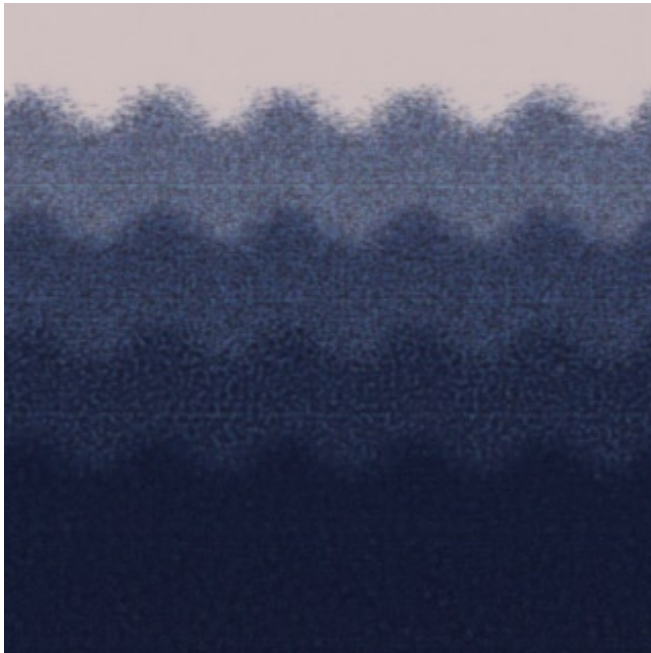


*Intelligent Interweaving option on*

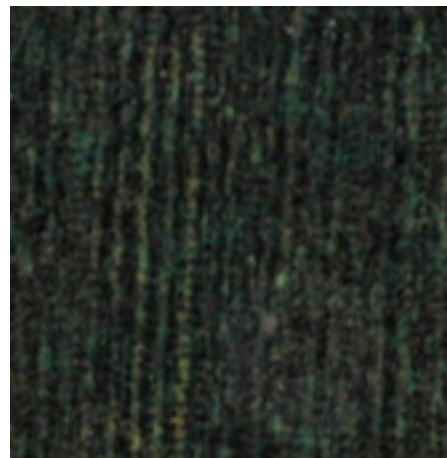


*Intelligent Interweaving option off*

*These are scans taken with our 80-megapixel Cruse reprographic digital camera/scanner.*



*Here are two different forms of the interweaving: wavy and non-wavy.*



*Before*

*The samples of the Mutoh prints were scanned by the \$75,000, 80-megapixel Cruse digital camera, one of the many high-tech features of the FLAAR facilities. Scans at this quality enabled us to see details.*

**Mottle with solvent inks**

Mottle is the splotchy pattern especially on glossy materials (but not limited to smooth vinyl). Mottle is a tell-tale sign that solvent ink is being used (water-based ink does not often mottle and when so not in the same pattern that is common with solvent ink).

Anything that gets rid of mottle and banding is given high marks by FLAAR.

**How do you get rid of these kinds of banding?**

You get rid of clogged nozzles by cleaning them (purging, sucking, wiping, etc).



***Cleaning the Mutoh Spitfire Extreme is simple and fast***

You overcome dead or otherwise defective nozzles by assigning a replacement nozzle. But this is possible primarily with HP, Ricoh, and a few other heads and printer firmware. Gandinnovations has software to replace nozzles-out on their Spectra heads, as but one innovative example. ColorSpan uses a “Buddy nozzle.” But most other printerheads lack a way to bring in a replacement nozzle: there are no replacement or backup nozzles on Epson printheads.

If the banding is caused by improper advance of the media or substrate, then you can dial-in a correction to the media feed rate. This implies that you have the patience to dial in the numbers and do a print test. This also implies that your printer facilitates this correction: Epson 7500 and 9500 printers did not allow the end-user to make this correction.

But to find which of the thousands of tiny nozzles is out, and to try to repair, replace, or overcome them, is time consuming. Not all printer operators are trained how to do this; and most that are trained don't have or don't take the time to run the maintenance procedures.

So banding persists; most printer operators ignore it, saying that “no one notices when the banners or billboards are viewed from large distance.

But banding, along with an ugly dot pattern, and mottle, are many of the issues that cry out, “this is an inkjet print and not a continuous tone image produced by a Durst Lambda or an Océ LightJet.”

**Intelligent Interweaving (I<sup>2</sup>), the first solution offered in the Inkjet industry**

***At the top, before Intelligent Interweaving is turned on; there are horizontal bands. The lower half (after the scissors), Intelligent Interweaving is turned on, and no more visible banding.***

When I first heard about Intelligent Interweaving I was skeptical. I assumed it was another buzz word. For years Encad had invented cover words, such as “Intelligent Mask Technology” to obscure the fact that it’s Lexmark printheads were something special (Lexmark are the worst thermal printheads ever made, if you compare them with more advanced Canon and HP heads of the same time). Apple Computer conjured up cover words for its Motorola chips to try hard to make them sound better than Intel chips.

You only found out the subterfuge when Apple switched from G4 to G5 and the ads for the G5 told you all the advances over the G4. Why in the era of the G4 did no one tell you all the features that were missing? Then Apple simply switched to Intel chips, without admitting that the former Macintosh chips (from IBM by then) simply were inadequate.

It’s the same in the inkjet world: most inkjet printer manufacturers make up utter nonsense to describe some imaginary benefit that is usually smoke-and-mirrors.

So please understand why I assumed that Intelligent Interweaving was fluff-and-puff, and invented solely to distract the potential buyer from a printer’s deficiency. Remember, all these silly advertising slogans are to keep you from noticing that the product is slow or merely average.

So the first thing I did was to check around, and ask other people. I was told that the Intelligent Interweaving was actually a viable technology. So I accepted the invitation by Mutoh to visit their factory, their headquarters demo rooms and training facilities in Oostende, Belgium.

Once I was inside the factory, and saw the care and effort put into manufacturing the machines, I realized they did not need smoke and mirrors. These printers are professionally designed and precision engineered: this is not cheap low-bid off-brand printers. These are not what you get resulting from Made-in-China factories.

Once I saw the end-results of the printers output I realized that Mutoh did not need to hide anything by inventing nonsensical PR blather. The Mutoh Spitfire Extreme, the Rockhopper 3 Extreme, and the Mutoh ValueJet are each capable of printing true photographic quality: I call it “exhibit quality,” meaning worthy of being exhibited in a museum. One factor in producing this exhibit quality is the combination of Intelligent Interweaving technology to the firmware that controls the placement and sequence timing of the placement of the multiple droplet sizes from the advanced piezo printheads.



*Mutoh Spitfire Extreme*



*Mutoh Rockhopper 3 Extreme*



*Mutoh ValueJet*

## Testing I<sup>2</sup>

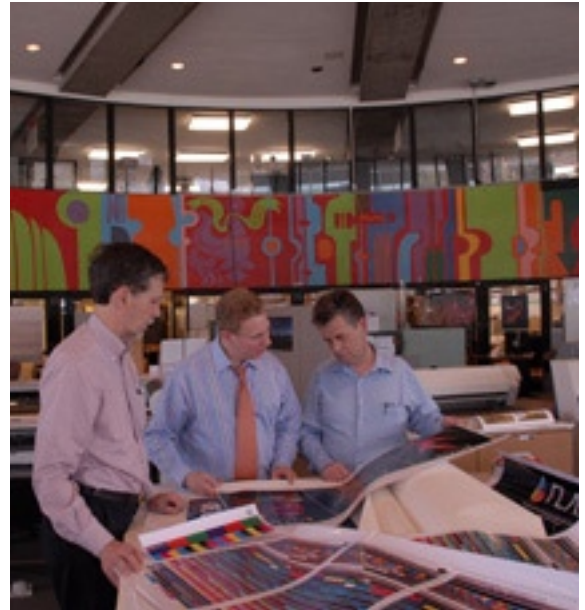
Until it becomes possible to have a Mutoh printer with I<sup>2</sup> at our FLAAR facilities, the most practical place to evaluate this new technology is at Mutoh Europe headquarters in Oostende, Belgium.

The process also involved evaluating the Mutoh Spitfire Extreme printers and also the Mutoh Rockhopper 3 Extreme printers, so that occupied much of the week, as did two lengthy factory visits (inside every part of the factory, see the separate FLAAR Report on the factory).

Once I saw the test prints It turned out that the results were better than I expected, so much so that when the former FLAAR manager visited Oostende that week, I asked if two framable fine art photographs of mine could be printed for her (she worked with FLAAR precisely during the years when we began to evaluate wide format inkjet printers in general and printing fine art giclee in particular). She assisted in the evaluations of our Encad NovaJet Pro 36 in the US office and with an HP Designjet 2800cp in Germany. In those years (1997-2001) no solvent printer was capable of true photographic output.



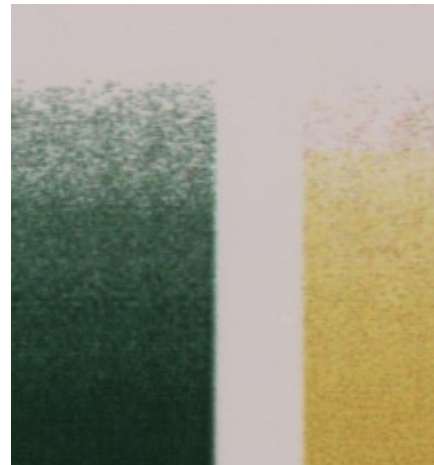
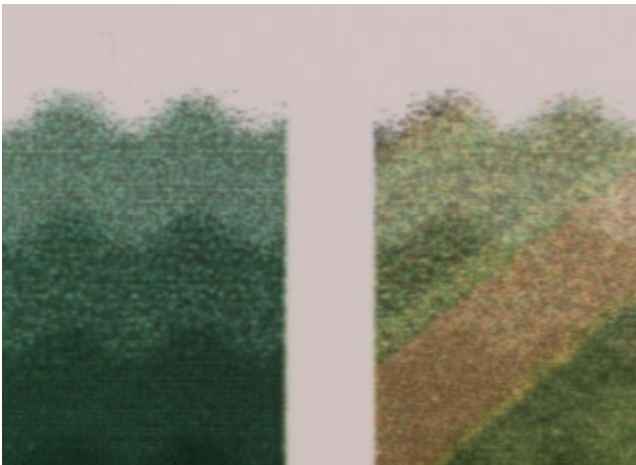
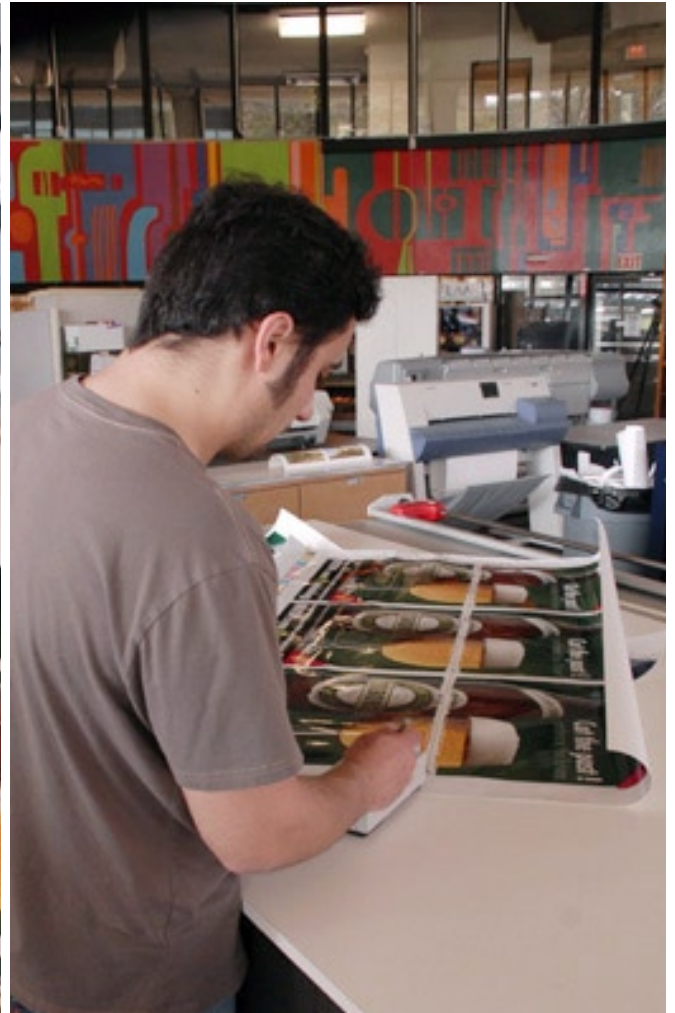
Yet now, in 2007, with Intelligent Interweaving, it was possible with eco-solvent and mild-solvent inks to produce museum quality giclee printers with images taken with a 30 MB PhaseOne digital camera system.



*William Birkett, Print Quality Consultant of Doppleganger LLC (center on first picture) and Professor Charles Spontelli of BGSU (College of Technology, VCT), viewing the samples showing Mutoh's Intelligent Interweaving. Dr Nicholas Hellmuth, FLAAR at BGSU, had these test samples sent from the Mutoh Europe factory demo room in Oostende, Belgium. These are some of the samples printed during Hellmuth's one week study of Intelligent Interweaving on the Mutoh Spitfire Extreme (mild-solvent inks) and Mutoh Rockhopper 3 Extreme (eco-solvent inks).*



*Bill Birkett, who specializes in press room calibration, production workflow (including wide-format inkjet printers and offset presses), and color management, said he felt the results were excellent, and that the dpi looked equivalent to 1400 dpi (these were 720 dpi prints using Intelligent Interweaving). He expressed interest in learning more about this technology.*



*In the FLAAR+BGSU lab, using the QEA instrument, and 80-megapixel scan from the Cruse, you can see the weaving pattern at the left, and the other pattern at the right. One pattern is for “pictures” (the waves); the other pattern is for large areas of dark colors (“signs”). Please understand, this is a cross-section of a deliberately unfinished weave, to reveal the pattern before it is finished. The purpose is to show that there are two forms of the pattern.*



*Portion of the black background scanned by the 80-megapixel Cruse digital camera*

*The photo of the purple heliconia flowers on a solid black background would tend to show banding defects on almost every printer, whether an HP Designjet 5500, an Epson 7800, or most solvent printers. Here the print was done with Intelligent Interweaving on a Mutoh eco- or mild-solvent printer at Oostende demo center. Using a \$10,000 QEA inkjet dot analysis instrument, Armen records that the image has no banding. I could not see any banding on the print with my eye, but figured we could spot banding if we looked at it microscopically:sorry, no banding.*



*Does that mean banding has disappeared? Well, if your printer is not properly maintained, if jets are out, deflected, or otherwise not firing properly, if you try to use the wrong media, inappropriate temperature, or try to use steroids to print too fast, you can probably get banding no matter what. But with Intelligent Interweaving technology, you can escape most banding, as you clearly see here.*

### **Currently two generations of Intelligent Interweaving**

If I understand correctly, the basics of I<sup>2</sup> were developed in Japan. Then the second generation (that was tested here) was developed by Mutoh Europe.

The Mutoh Spitfire Extreme (mild-solvent) and Mutoh Rockhopper 3 (eco-solvent) have the second generation. Any other Mutoh printer with Intelligent Interweaving has the first generation.

### **Increased User Friendliness**

Printer operators don't have so many decisions to make if they understand Intelligent Interweaving. So tech support does not have to explain complex options.

### **Bibliography**

75% of what is on the Internet is either a direct repeat of corporate PR or simply the PR release reworded. The other 25% are either Success Stories, sort of formula-like PR releases, or PR-like comments in trade magazines. So I have not yet found any outside reports.

***First posted April 2007***



*These photographs, taken with a \$32,000 digital camera, would normally be printed on a fine art giclee printer. But the Mutoh Spitfire Extreme did a capable job of rendering these images at outstanding quality.*

*Look at these blacks: pure black, with no ugly banding defects.*

