White Ink Isn't Just Black and White

BY DAVE KING

David King is director of operations for Massachusetts-based Castle Graphics. He has been in the digital industry for more than 21 years and works with a number of major manufacturers to help develop new and better technologies. In addition to writing for Digital Graphics Magazine, *Dave is a frequent speaker at* **The Sign Business & Digital Graphics Show**. *He has also produced* Inkjet Printing, Laminating and Mounting, *an educational video for the* Video Classroom *series. For more information call 1-800-691-8047.*

When my shop was looking to purchase a UV-curing flatbed printer, we did a lot of research and narrowed it down to two great machines — one offered higher resolution and the other had white ink capability. None of the white-ink-capable flatbeds I looked at offered a high enough resolution for my shop's needs. The million-dollar question then became: *Will white make me more money?* The answer, of course, is *Yes and No!* Of the last 60 jobs we bid on, about 15 of them could have used white — that's 25 percent. This was a *very* difficult decision. Many of my clients wanted high resolution *and* white. Clearly, I wanted it all, but I had to choose — and so I did. Here, then, are my findings and thoughts about white ink.

WHAT IS WHITE INK?

White ink isn't like other colors. The pigment is made from titanium dioxide (TiO_2), a compound that has a very large molecule and is much heavier than other pigments. As a result, white pigments are very difficult to keep in suspension, and the big particles cannot easily be shot from a tiny inkjet nozzle. White tends to settle, causing the printheads to clog. Manufacturers have

gotten around this problem in different ways (most are employing some kind of stirring mechanism), but these issues are why so few printers now offer white as an option.

In speaking about white inks with various manufactures during my flatbed search, I got very positive feedback from some and others told me white was "just a fad." I think they're trying to convince themselves that white is just marketing hype. Sure, tell that to all the screen printers who have been using white for years. I could talk someone's ear off about the technical issues behind white, but I have a feeling that everyone would rather hear about its practical applications.

APPLICATIONS

There are four major applications for white on digital graphics: white as a base or floodcoat, white as a spot color, white as a fill color and white as an overcoat.

White as a Base or Floodcoat — To print onto a colored surface (any color other than white), print white on the entire surface, then print the image over the white ink. Does this require running the board through the printer first to cover it with white ink? More on this later.

White as a Spot Color — If certain elements in the image are white — like a soccer ball on a piece of birch plywood, for example — print only the spots needing white, allowing the other colors to blend with the surface. The spot color will jump off the page. Again, this is not typically printed on a white surface, but a white spot color can add punch to just about any print.

White as a Fill Color — Photoshop users who have selected the *Background Transparent* option know about the weird checkerboard background — indicating "transparent" areas where ink is *not* to be applied. Now, white ink could be applied in those areas. Ideal for special jobs on surfaces that are, again, not typically white.

White as an Overcoat — This is for clear backlit applications and nine-color jobs. A clear backlit display requires reverse-printing on a surface, followed by over-printing with white to provide a solid background. A nine-color job can produce double-sided prints on a clear surface. First, reverse print an image on the clear surface, then overprint the entire surface with white, and finally, print the next image on top of the white, resulting in a nine-color job just like screen printers do all the time.

Here we see a number of print samples — all requiring the use of white ink. Although fairly specialized, there is money to be made with white ink applications.

WHITE AND 360 VS. 600 DPI

These days, most large-format print customers want prints of at least 600 dpi. Okay, they're spoiled. Eventually word gets back to printer engineers that what's needed is a printer that can fire white ink at 600 dpi — essentially, that's like asking somebody to push a marble through a Bic pen. Either the marble has to be made smaller or the pen bigger. That's why the white-capable printers that offer a good, solid opaque white (such as the Durst Rho) are only 360 dpi. They opted for the bigger pen.

Certainly, by thinning the white enough, it can be pushed through a 600 dpi nozzle, but that white tends to be very transparent, defeating the purpose of most white-ink applications. Not a good solution.

I have a novel concept for any printer manufacturer reading this article and struggling with this problem. What about putting a set of 360-dpi white printheads on the print carriage alongside the 600-dpi CMYK heads? Guess what? The white portion of almost any application will never need anything higher than about 100 dpi. I know I sound a little wacky, but pass that idea down to your engineers — it might just work!

OPACITY?

I love to hear a printer sales guy tell me that, "*our white ink is opaque*." Sure it is — *Not!* If it was truly opaque, then it would not work for a backlit application. After all, the word "opaque" means "impenetrable by light." They'd be better to describe their ink as having "*good opacity.*"

I guess what the manufactures are *trying* to say is that their white is good for printing onto colored surfaces — that the color of the surface will not show through. I think they are also trying to indicate that the white ink is also *translucent* enough for clear-surface applications, like backlits, where you want light to come through. A good test for the printer's white capability is to print onto a paper-based black surface, like black Gatorfoam, and then see if the

White is ideal for all types of applications on clear substrates, such as the clear film being printed to here with the white-capable Durst Rho 160W.
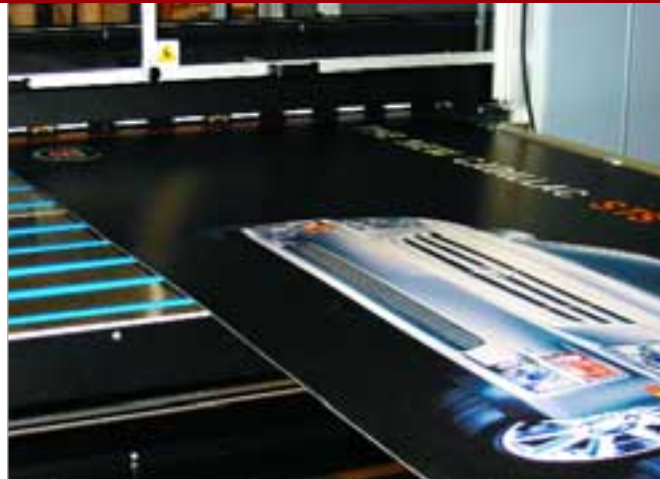
Here, the client, Cadillac, demanded the finest quality output on a rigid black surface — printing onto black Sintra, using white primarily as spot and filler color.

Close-up view of the Cadillac print shows the excellent printing qualities.

printed white matches the pure white of a polystyrene sheet.

SPEED
The next consideration with white ink is speed, and this is where printhead configuration becomes important. White-capable printers featuring *staggered* printheads print white well, but *inline* configurations don't. The Aellora Digital white-ink system allows for inline printheads, but that's unique (see accompanying story).

Consider this: if I want to print a base or floodcoat onto a board, I'll need a set of white printheads positioned first on the print carriage. That allows the white to be put down and cured before the other colors come along and print the actual image. With this configuration, I could do three of the four print options. But to do overcoat printing of white, the white printheads would have to be the *last* heads in the system. To do a nine-color job, the printer would have to print the image, then the printer operator would have to feed the substrate back in the printer and print and cure the white base or floodcoat, then print the next image over the white.

A number of manufactures design their printers with inline printheads, and some have told me that they can make the inline printheads work with white. The truth is that they *can*, but not without a significant speed reduction to accomplish the four white-printing options. Most good flatbed printers run between eight- and 48-inches per minute, with the average being about 12-inches per minute.

Compared to printing, laminating, mounting and cutting a print, today's flatbeds are really *fast*. But to stand and watch a board printing for seven minutes, it feels like the print will *never* come out! So, if the manufacturers slow down the printing for white-ink applications, they will have some very upset clients.

SOUR GRAPES
Okay, my flatbed buying decision ultimately went to the higher resolution, rather than the white-ink capability. Clearly, we are walking away from 25 percent of the quotes we get. But I think that in today's white-crazed market, white materials still overshadow colored materials. Despite the availability of wood, metal, colored films, colored sheet, colored tile and other colored materials, there really isn't much call to print onto these substrates. If a client requests an edge-lit, clear acrylic, half-inch wall-sign that *must* have their logo floating in the center, guess what: I'll need white. Yeah yeah, I know. Sour grapes.

MY DREAM
Yup. I wish I had white ink in my printer — I'd make a lot more money. I would use it every day on the jobs we run. I have a dream that all of the flatbed manufactures will read this article and get their engineers to put 300 dpi white printheads alongside 600-dpi color printheads so we can all have white *and* higher resolution in the near future.

ANOTHER APPROACH TO UV INKS

About a year ago, a New Hampshire-based company called Aellora Digital (a Markem Company) came up with a unique solution for UV-curable inkjet inks called "Hybrid UV Ink." It's a thick paste rather than a liquid and has some interesting properties. The company has been demonstrating the capabilities of its white ink at recent trade shows.

Typical liquid white-ink delivery systems require some kind of stirring mechanism to prevent the heavy titanium dioxide pigments from settling. Since the inks in Aellora's system are so thick, no stirring is needed. Rather, heat (158ºF) is used to liquefy the inks when they fire through the inkjet nozzles.

Also, unlike liquid UV-curing inks, this ink leaves no banding tracks (railroad tracking) when printing bi-directionally. This allows printheads to fire at full speed, resulting in potential output speeds of about four linear feet per minute (roughly 1,600 square-feet an hour on an 80-inch machine). The next major feature of this new ink is the fact that the printheads can fire all the inks on top of each other without having to cure between colors.

With this approach, printers equipped with inline printheads could print white-ink applications without having to go back and print over a cured white floodcoat — cutting printing time for this type of application by about 50 percent.

The final issue is lamp heat. With typical UV-curing systems UV lamps are mounted to the printhead and intense heat is generated when curing the inks quickly as the printhead shuttles back and forth. This heat causes some materials to warp, making UV-cure printing difficult on sensitive substrates. If a printer were set up with a thick-ink system for all colors, a full-width bank of UV lamps could be mounted away from the printheads. The lamps could cure more slowly and evenly and with much less heat, since they would not be shuttling with the printhead. As a result, I believe a wider range of media could be used.

These are just some of my thoughts after reviewing this unique UV-curing ink delivery system. I'm surprised that more manufacturers have not jumped at the chance to design a flatbed printer using Aellora's system. There seem to be a number of advantages with this approach. **DG**