

Single-Pass Inkjet for Graphics Applications: A Thorough Consideration

While single-pass technology is an attractive option, it's not always the right one for graphics producers.



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For this article, it is important to first define the boundaries of the discussion. While the term "wide-format" is often used as a shortcut to describe digitally printed signage and display graphics, wide-format inkjet technology has grown in scope, expanding beyond its graphics-based roots to also be used in certain manufacturing sectors. This article's focus, however, is on the graphics and signage sector. While other sectors will be addressed herein, they are not the stars of this discussion.

Technology's Promise

In the early years of the wide-format digital graphics segment, many criticisms existed about the technology: the color was not as good as could be reached with analog processes; the durability of the prints limited application areas; and, most importantly, the systems' speeds were not appropriate to address production-focused graphics businesses' needs. Since then, due to strong product development by equipment, printhead, and ink developers, those common objections have largely been addressed. This, coupled with changes in marketing and design — partly brought about by the capabilities of digital printing — resulted in more short-run jobs, which helped to fuel the digital printing revolution, and bring about the graphics segment as it's known today.

Regarding the early technology criticism pertaining to print speed, single-pass inkjet — also known as full-width-array inkjet printing — was for a number of



Aleksek_Derin, Getty

years seen as a print speed end-point for wide-format graphic printing. On these systems, as they were proposed, a full array of inkjet printheads would span the width of the machine's print area. In doing so, neither the printheads or the print platen would have to shuttle back and forth as the substrate was printed, laying down ink in interlocking strips of droplets. Instead, the substrate would move under the heads just once, and the full image would be completed during that "single pass." This development, when perfected, would result in a massive increase in throughput, thus supplying graphics producers possessing these systems with a speed-focused competitive edge.

Considering all of that, development of single-pass systems for the wide-format graphics segment is no longer the focus it once was. Further, among top graphics producers, the promise of these systems as a sort of Holy Grail has also waned. So, what happened, and are the highest-speed systems on the market today enough to meet the needs of today's top graphics producers? Further, where within the wide breadth of inkjet printing has single pass taken hold, and why?

The Need for Speed

It is safe to say that among the many inkjet devices produced by the manufacturers serving today's graphics segment, all are likely capable of producing quality, salable work, especially when used by operators who are adept in color management, quality-focused workflow, and routine maintenance. The same can be said with ink durability. Print speed, however, is a variable where the range of possibilities is vast, and the price of the printing device is dependent on that speed. Print speed should be calculated based on the amount of work a given graphics producer does (or reliably expects to do). In a very neutral way, it can be stated that "you get what you pay for." According to Larry D'Amico, sales director, North America for Durst Image Technology US, current satisfaction with print speed is nominal, and companies are addressing the need for additional capacity by adding more machines, as opposed to a single inkjet system that addresses all needed capacity.

To further explain, one can compare the technology to automobiles. The automobile most people need is one that operates effectively between zero and 80 miles per hour (which is generally the top-end speed limit in the U.S.). Due to these limits, most of the vehicles purchased are designed to operate between those speeds, and the average price for an American car is just under $37,000. Conversely, a 2020 Lamborghini Huracan is designed for speed, and is capable of reaching 202 miles per hour. Pricewise, it "starts" at $208,571. That's a lot of money ▸

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for a car that one may never drive anywhere that would allow for getting close to its top speed.

It's similar with inkjet systems for wide-format graphics, where too much speed can also result in too much cost. As an example, D'Amico says that the high end of the Durst US UV flatbed portfolio is capable of printing up to 220 4x8-ft. boards per hour. By comparison, he says, a similarly sized single-pass system could produce between 3,000 and 5,000 boards per hour. While those numbers are certainly astounding — especially for a printing technology that was once seen as "too slow" — there are few companies in the graphics sector that have need for that high rate of production. Also, there are few companies that can invest in a multimillion-dollar machine and not run it at anywhere close to its top speed.



Display produced on the Durst Delta SPC 130 single-pass corrugate printer.
Courtesy of Durst Image Technology US.

The Road Driven

One of the factors that differentiates the wide-format graphics sector from other areas of printing is its diversity. The mix of ink systems, materials, and finishing technologies used in the sector is what makes it exciting and less prone to commoditization as, say, offset lithography. It is the mastery of these elements — much more than the speed with which the print is produced — that makes most companies successful. The wide-format graphics sector is a high-touch, short-run-focused, highly specialized space — a reality that doesn't fit, especially with high-speed capabilities of single-pass systems.

Returning to the example of the Lamborghini … just picture the car. It is low to the ground. Too low, perhaps, to clear speed bumps or railroad tracks; too fragile to stand up to potholes. It is made for, and succeeds on, a smooth road.

Companies working in the wide-format segment use a wide variety of materials, including rolled plastic, vinyl, rigid plastics, PVC, clear acrylic, metals, and fabrics, and may use a variety of these on the same machine on any given day. For some of these materials, salable printing may require varying print speeds and special attention to drying or curing. In some cases, a specific ink system — solvent, for example — cannot supply the ink adhesion needed to successfully complete the job.

This variety of substrates, multiplied by the number of ink sets available (aqueous, solvent, UV-curable, dye-sublimation, and more), creates the complex grid of possibility upon which the wide-format graphics segment is built. Flexibility is what is needed, and a super-fast, super-expensive single-pass machine is a Lamborghini when most graphics producers need a well-equipped SUV.

Where Single-Pass Makes Sense

Though single pass may not be the right tool for the job for most graphics producers, this does not mean that it is not the right tool for some businesses.

Single pass has made strong inroads into the corrugated packaging market, which, according to Mark Hanley, president of the industry consultancy IT Strategies, is 100 times larger (in square meters printed) than the graphics segment. Two factors make single-pass technology work for corrugated. The first is that corrugated is a homogeneous substrate, as compared to the wide and diverse range of substrates used for graphics production. Further, the single-pass systems work well with legacy finishing systems that trim, cut, perforate, and glue packaging products. While the printing device has shifted to digital, the process is still largely analog.

Vince Cahill, president of the industry consultancy VCE Solutions, shares that single-pass inkjet is also gaining traction in the printing of fabrics for clothing and decorative markets. He says the print speeds of today's top units have reached parity with the print speeds of rotary screen printing, which has long been the go-to technology for that segment. Again, compared to graphics production, fabric printing uses a rather homogenous range of substrates and dovetails nicely with existing mass-production models.

Single-pass inkjet is also seeing increasing use in specialty manufacturing, where bespoke systems are integrated into existing production lines. These systems are commonly used in the printing of finishes for laminate flooring and ceramic tile. These systems are generally not what the graphics segment would consider wide-format, and they don't have to ▸

be. They are designed for a singular purpose, and print width is based on the size of the "widget" being printed upon. These systems, in particular, have led to vastly different models for certain markets that were based on traditional mass-production, and have now expanded into easy versioning and zero-inventory models.

Hanley adds that one segment of graphics production where single-pass inkjet does make sense is in the creation of corrugated displays for retail and other settings. While one might think that particular application would be an easier reach for packaging converters than for graphics producers, he adds that the production of these displays doesn't fit with the mass-quantity/low cost-per-unit production flow common to converters.

Costs and Complications

According to Jason Kammes, sign and display inkjet sales manager for Fujifilm Graphic System Division, the "ship has sailed" on single pass for wide-format graphics. This reality is caused by two significant factors, the first of which is cost. As previously noted, these systems start in the millions of dollars, and all that gets a business is the printer. Even with the fastest non-single-pass systems on the market today, their true speed is realized only through the addition of mechanical or robotic take-on and take-off systems that can place and pull boards and other substrates with no lost time. While these systems can load and pull more efficiently than a human, they come at a significant cost. If a company is pursuing a model that supports the cost of the equipment, labor, and more, then single pass is a possibility. However, Kammes says that for most companies, it is "difficult to work out the math."

Further, anyone who knows the wide-format graphics segment is well aware the printing device (inkjet printer, in this case) only makes a print. In most cases, making that print into the product the customer expects requires finishing, which can include trimming and cutting, lamination, and fabrication. For instance, to make single pass successful, a graphics operation that banks on high speed throughput would also need to make significant investment in cutting systems. Using the Fujifilm Onset X3 as an example, Kammes says that in order to maximize throughput, that system needs to be supported by three CNC cutting systems. Using simple math, one can imagine the additional space, labor, and expense required to triple (or even double) that higher number of systems.

For most printing businesses, while the passion may be in the "printing," the focus must be on the "business." Any highly significant investment in technology must be supported by careful research and a firm grasp of the numbers. Any system must be right for the needs of the given business, and for the vast majority of businesses operating in the wide-format graphics space, pursuing single pass is (for now) a non-starter.

What the Future Holds

Will single-pass inkjet ever be the go-to technology for the wide-format graphics segment? Odds are, in time, yes, and the change will be driven by several key factors. The first is an increase in the reliability of printheads, in which jet-outs, necessitating redundancy, cease to become a concern. The second is a decrease in the cost of printheads, which will lead — and already has — to the relatively affordable, wider arrays found in today's top systems. The last factor will be a lower cost of the equipment overall, which would create a reality where the inkjet device would not need to generate revenue 24/7 simply to cover its own payments.

At the risk of offending Lamborghini owners, the metaphor used to illustrate the state of single-pass technology rings true. While the flash, speed, and excitement of an "over-the-top" car, or inkjet system, may be attractive, the choice that does not meet the needs of one's life — or those of a business — can be an expensive mistake. ■



A graphics production segment where single-pass inkjet does make sense is corrugated displays for retail and other settings. Courtesy of EFI.

Dan Marx's extensive knowledge of the graphic communications industry results from nearly three decades working closely with business owners, equipment and materials developers, and thought leaders. With a focus on new technologies and their related opportunities, he has been published in industry publications worldwide, presented at industry events across segments, and served as an enthusiastic ambassador for new processes and business opportunities. He is available to write, speak, interview, host, moderate, or help you tell your story.