

Wide-format Digital: Book One

Exploring the birth of wide-format digital printing

BY ETHAN ELLIOTT

Ethan Elliott is Associate Editor for Digital Graphics magazine.

Editor's note: This is Part I of a two-part retrospective on the large-format digital printing industry. Because of the complexities involved in its evolution, and the number of significant players and influences involved, a comprehensive history is not practical within these pages. This segment does not examine the development of large-format inkjet printing, despite its overlap with electrostatic technologies. Look for Part II in a future issue of Digital Graphics which will trace inkjet developments.

Since this issue of *Digital Graphics* arrives just in time for the 2006 SGIA show, current home of the DPI users conference, it seems an excellent time to look back at the birth and early roots of the digital printing industry. While still infant enough that most current users pre-date the technology, few have had a hand in since the beginning.

Tracing the origins of a highly technical industry is about as difficult as learning to master the technology; but genealogy is fun. With that in mind, sit back and enjoy chapter one of the good book, *Digital Graphics*. Before DPI, before inkjet printers, there was a growing buzz referred to as "The Digital Revolution."

IN THE BEGINNING

In the beginning computers displayed only text, and graphics were produced in an analog fashion. That was that; end of story. That is, until a few pioneering computer engineers began playing with graphical display.

Initial efforts focused on placing graphics on screens, and were met mostly with hardware challenges. Much early research was done at universities, one of few places where new-fangled computer technology was available. As a result of incremental steps throughout the 1960s and 1970s, people put graphics on computer screens. That was that; end of story.

But what good is a nice on-screen image if the picture can't be output? That

While computers had been mated to printers for decades, output was limited to text until the 1980's. Shown here is the Xerox 9700 Electronic Printing System, the first xerographic laser printer product, released in 1977.



question led another round of pioneers to search for an answer.

Foremost among these early experimenters was Harry Bowers, an applied physicist at Berkeley and chairman of the photography department at the San Francisco Art Institute. Scientist by day and photographer by night, Bowers was fascinated by the creative possibilities that digital data presented.

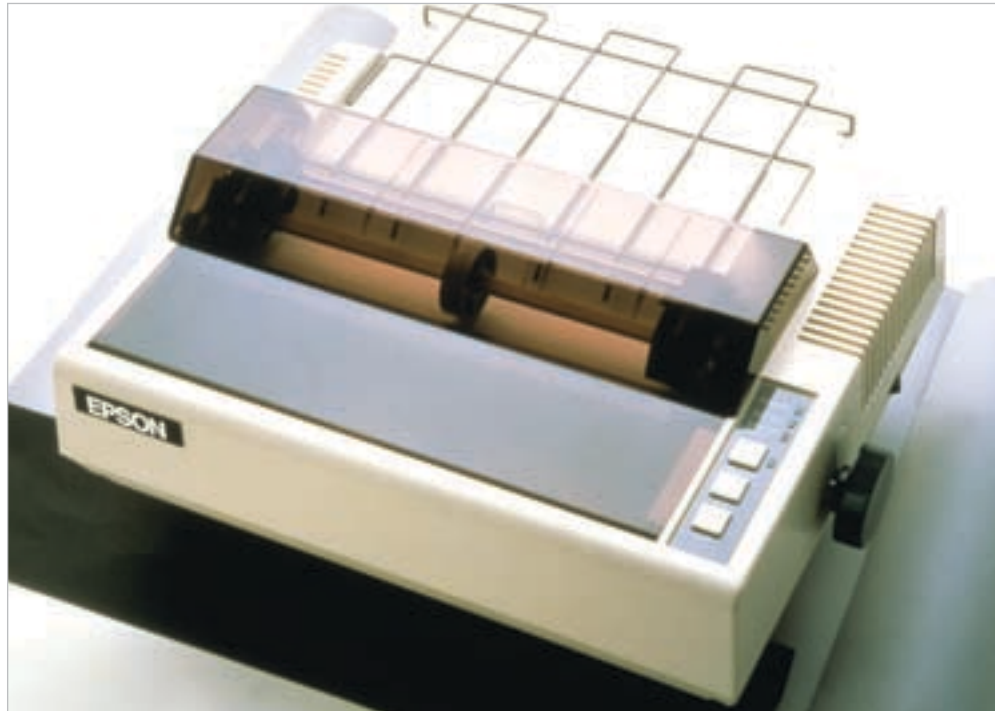
“I got involved with computers in 1966, working at Harvard. Computers are digital, any way you shake it,” says Bowers, who began searching for a way to reproduce his photographic art digitally in the early 1980s.

It was then that Bowers came across a book published by the MIT press that described stochastic screening. Using the information from the book, Bowers and his son John wrote a program in Pascal to print a digital picture.

IBM introduced the first dot-matrix impact printer around 1957, but to that point there had been no recorded success of using printers to output graphics. Bowers’ program, written in 1985, accomplished the task — a feat that many felt was impossible. The door opened.

Around that time, Bowers met Apple Computer co-founder Steve Jobs, who was preparing the Macintosh computer for its 1984 release. Bowers saw immediate potential, and after a brief meeting, an interested Jobs gave Bowers an early Mac to experiment with.

Despite the fact that its screen was black and white, Bowers successfully re-programmed a 128k Mac to do color separations for four-color graphics on a dot matrix printer with colored ribbons. Using input from a TV camera fitted with RGB gel filters and a digital frame grabber, he created the first digital color print.



The 60 x 72 dpi Epson MX-80 dot matrix printer sparked the initial popularity of printers in the personal computer market.



Adobe first wrote PostScript in 1984, followed a year later by the release of the first PostScript printer and image setter, the Apple LaserWriter. The device-independent page description language provided all PostScript printers with a universal language. Cactus licensed PostScript in 1990.



Wide format pioneer Harry Bowers and wife Dot Barad at their shop in New York City in 1996.



"The Cactus system was one of the best purchases we ever made," says Joe Thompson III, owner of Berry & Homer. "The learning curve was not that bad; the equipment was fast; that was a joyride."

Soon, Bowers' digital half-toning algorithm could successfully output dot-matrix color graphics from input devices such as the Barneyscan film scanner (which shipped with Photoshop 1.0) and the original digital camera (a \$30,000 Kodak).

The problem was, the printers simply weren't *big* enough. Large graphics had to be tiled over a series of 8.5" x 11" sheets then taped together to form an image. Lacking larger dot-matrix technology, Bowers turned next to reprographic printers. There he met new challenges.

Electrostatic printers and pen plotters existed in reprographic circles, but had been designed to receive *vector* instructions to output blueprints and line drawings. That was that; end of story. Except, Bowers thought it might be possible to remove the line from two points and instead lay an X-Y *dot*. With an infusion of \$500,000 from venture capitalists, he founded Bowers Imaging Technology (BIT) in 1986.



The gang from Cactus takes a break to pose for pictures.

"The Cactus part of the story is interesting for very early developments in color management, but the real innovation in printing was done at the Bowers stages," says former Cactus salesman Stephen D Schaffran.



LET THERE BE LIGHT

Bowers quickly purchased a \$120,000 Versatec ECP-42 electrostatic color printer and John ported the digital half-toning software in Fortran for a Digital Equipment Corporation (DEC) mini-computer system. Ren Zephroplous, founder of Santa Clara, Calif.-based Versatec, met with Bowers and later remarked to district manager Tom Avanzato (now a business manager at 3M), "Someday you're going to see these prints on airplanes, buses, everywhere." Avanzato didn't believe him, and wasn't alone. Some still regarded Bowers as "the lunatic fringe from Berkeley."

Once the printer was in hand, another problem arose: resolution. Bowers purchased a Crosfield MagnaScan 500 drum scanner for \$320,000 and hired a group of engineers, who spent the next eight months developing a signal converter. It was at that time that Bowers met his pres-

ent wife, Dot Barad. As Adobe Postscript was yet to be applied to such wide output, in 1988 Bowers and Barad developed a method to scan and vectorize fonts using quadratic interpolation that allowed text to be scaled to any size.

Within months, Bowers Imaging was making pictures on the Versatec. The first large-format print Avanzato remembers seeing was a 42" x 10' Nike runner done by Bowers Imaging. Six months later, the venture capitalists invested \$1.7 million in the company, and BIT opened its doors as a service bureau.

"Most photo labs back then were mom and pop shops," says Bowers, "they couldn't spend \$400,000 on a print system," but they could spend money on giant prints.

Suddenly, Bowers Imaging Technology wasn't just a game: it was a business. The lunatic fringe now seemed sane. While BIT was high on engineering ability, they were low on market oversight. New part-



The Digital Printing and Imaging Association (DPI) was initially launched from the Onyx Users Group, with just over 100 members. In 1995, the association became part of the Specialty Graphics Imaging Association (SGIA) tradeshow, and now has more than 4,000 members, according to SGIA president Mike Robertson.



Kelli Ramirez (left), Linda Long, Mike Milliken and Rak Kumar man the Raster Graphics tradeshow booth.



The DPI show in 1996. "DPI was a natural fit with SGIA because of the product offerings. SGIA's role was initially to transition screen and digital people. It was really something to rally around, and it catapulted DPI in size and interest. Now we see DPI more as a community within SGIA," says Robertson.



The Versatec/Xerox 8954 was one of the first e-stat printers marketed directly to the signage industry. The machine is still used today with dye sub inks for textile printing.



The DCS 5442 was another successful 54" wide e-stat printer from Raster Graphics.

Xerography developed by Chester Carlson
 IBM debuts computerized dot-matrix impact printer
 Calcomp 565 drum plotter accepts computer input
 Ivan Sutherland invents predecessor to CAD
 DEC launches "mini-computer" (\$25,000 retail)
 Ed Catmull displays his left hand on a computer monitor
 IBM introduces first laser printer, the 3800
 Adobe invents PostScript
 Bowers Imaging Technology Founded
 Bowers produces first large-format digital print

WIDE FORMAT TIMELINE

1938 1957 1959 1963 1964 1974 1976 1984 1986 1986

ners were brought in. Attitudes changed. Harry grew uncomfortable with the heavy business pressure, so he moved on.

"The thing about people who invent a new technology is, about the time they perfect it enough to turn heads, the world starts to turn on them," says Tony Federico, a chief engineer at Xerox. "The problem is, the real pioneers are upsetting apple carts. And the ones that invent something with a major impact — well, they're upsetting a *lot* of apple carts."

Harry left BIT in 1988 and turned his attention back to research. BIT was later renamed Visual Edge.

CROWN OF CREATION

Because he had agreed not to directly compete against his own company, Bowers switched back to Macs. With the addition of a digital signal process card, his Macintosh computers were soon digitizing images at 25mhz. But there was still work to be done.

Over the next few years color monitors became available and Sharp introduced the JX 610, the first flatbed desktop scanner. When the scanner was paired with the beefier Macintosh and a color monitor, the cards fell into place.

Around 1990, toner-supplier Romit Bhatnacharya and partner Jack Keller of Specialty Toner Inc. partnered with Harry and John Bowers and formed a new company called Cactus, "the Cadillac of digital printing," in Santa Fe Springs, Calif. The idea was to develop a proprietary print system that would lead to an increased use of profitable consumables such as toner and paper - the "razor blades" sales model.

Now, with additional financial backing and color equipment, Bowers seriously addressed the issue of making the image in the monitor look like the print. Drawing from physics and numerical analysis knowledge, father and son wrote a color correction engine using 3D color lookup tables. The color correction system could be added to a Cactus print system for \$40,000. Bowers and engineer Doug Clark next developed a Toner Control Unit (TCU) to maintain the high toner levels required by graphics printing.

Bowers later worked with Xerox to create the Versatec/Xerox 8954, a 54" e-stat printer equipped with the TCU. After a few more tweaks, it was time to roll. Cactus took the system to the 1990 CeBIT electronics fair in Hannover, Germany, and sold two \$440,000 machines the first week.

TOWER OF BABEL

But Bowers wasn't the only person working the kinks out of wide-format digital printing. Onyx was developing software for a Precision Image CAD machine and for the Versatec EDOC machine.

"Chuck Edwards (founder of Onyx) was one goddamned smart guy," says Bowers. "He was my competition, but he was a *brain*. And he liked the kind of stuff I was doing." When the two met at CeBIT, Bowers "about fell off [his] chair" when he discovered that someone else was working on a large-format digital printing system.

Once the competitors met, the race began. First, each wanted top honors as the preferred print developer. More importantly, each company had developed a proprietary system. The engineers realized that the survival of digital printing it-

self hung in the balance, and they needed to get on the same page.

"The real battles of power were between Cactus, Onyx and Visual Edge," says Avanzato. "They were all strong players, with good quality and good knowledge." The trick would be to get that knowledge into the hands of the people. To that end, users groups were developed.

Cactus had a users group and so did Onyx. There was also the Seybold Conferences. All were set up to promote and demystify wide-format printing. "The biggest challenge was the technology. The technology was beyond what most people could manage," explains Kelli Ramirez, marketing manager for Océ and Onyx.

When the first Onyx Users Meeting was held, in Park City, Utah, in 1993, the biggest user complaint was that 'all of these machines are CAD printers, and what we really need is a dedicated graphics machine,' remembers Rak Kumar, current president of Raster Printers. At that time, Kumar worked for Raster Graphics and was looking for the next big thing. Realizing that the large-format graphics market was about to explode, he took notes.

Kumar recognized the fine line between success and failure in the fledgling industry. If he jumped in too soon and gave up on CAD, his company could fail. He first needed to perfect color, then he needed the right size printer. It didn't take long.

In 1994, Raster launched an electrostatic printer designed specifically for wide-format digital graphics, the DCS 5400. The 54" five-color Digital Color System supported CMYK plus one spot color, and was the perfect size for printing bus shelter graphics.

Brothers Thomas and John Knoll develop Photoshop	Onyx Graphics Founded	Cactus founded	3M unveils Scotchprint Electronic Graphic System	Cactus licenses Postscript from Adobe Systems	Onyx holds first Users' Meeting	Digital Printing and Imaging Association (DPI) founded	Raster Graphics launches DCS 5400 wide-format printer	DPI becomes affiliated with SGIA	Raster Graphics buys Onyx	3M releases Scotchprint 2000	3M buys Cactus	Onyx PosterShop 4.0 supports ICC profiles
1987	1989	1990	1990	1991	1993	1994	1994	1995	1995	1996	1997	1997

"The DCS 5400 and Xerox 8954 machines changed the face of the industry," says Kumar. "They had really attractive business models, because you could produce big graphics for \$1 per square foot and sell them for \$10."

THE GREAT FLOOD

The Onyx User's Group evolved into the Digital Printing and Imaging Association (DPI) in 1994. One year later, Raster Graphics acquired Onyx.

It was during the early '90s when large-format digital printing really solidified, recalls Ramirez. Shops started to have success in large-format, and an increasing number of manufacturers were jumping into the game.

André Schellenberg, founder of André's Imaging, now in Chicago, opened its digital doors in 1990 with the purchase of two Xerox 8954 e-stat printers, equipped with the first version of Onyx software, which was "a godsend," according to company president Rick Cappelletti.

Rich Thompson, owner of Pampano Beach, Fla.-based AdGraphics, invested in 3M's Scotchprint Electronic Graphic System in 1992. The system consisted entirely of 3M products including transfer paper, vinyl, toner and the Scotchprint 9510 electrostatic printer, which 3M developed through a partnership with Synergy Graphics a year earlier. "We were the first ones in the industry to start doing full bus wraps," Thomp-

son says. "In those days, we had to perforate our own vinyl for the window graphics." Because the 9510 was only 36", Thompson later bought the 54" Raster Graphics DCS 5400, and finally settled on the Scotchprint 2000 when it became available.

Philadelphia-based photo printing lab Berry & Homer, purchased a Cactus system. "That machine was great," says owner Joe Thompson III. "It made 200 dpi, four-color graphics at 1,000 square feet an hour. It was almost *too* good. It made us believe that anything we bought would be that great. A lot of people bought different machines, but if you chose the wrong solution, you wouldn't survive the flood."

"The original battle was PC versus Mac," says Onyx vice president Neil Baker, as the original version of Onyx was written for DOS, while Cactus was ported to Mac, he says.

Soon printer companies stopped offering incentives for the sale of hardware, which was a good thing. RIP makers then switched to a software-only sales model, explains Baker, which gave them incentive to expand their printer compatibility, further bridging the gap. This process was further assisted when manufacturers began licensing the Adobe PostScript engine for wide-format printers.

In 1997, the partners sold Cactus and all intellectual property to 3M, who later adapted the system to the Scotchprint 2000. "3M was the first company to ap-

proach digital printing as a *signage* solution," credits Kumar. "But Harry Bowers is a real pioneer in wide-format. He definitely gets the credit for that."

But Bowers isn't the only star in the story of digital printing. The engineers, businessmen and sales people who were in it from the start all share the credit — and the memories.

TREE OF KNOWLEDGE

"I loved every minute of it," says Avanzato. "It was the most exciting time in my life. It was tough, but it was all worth it. To look at the wide-format industry today, to see where we've come from, it's not so much a *revolution* as an *evolution*. It's only going to get better, bigger, faster. When I go to the tradeshow and see the Scitexes and Mimakis of today, it's amazing to think where we came from."

Today's advanced hardware and RIPs have tremendously simplified the process of using a digital printer, allowing anyone who can afford equipment to become an "expert." This involves no software programming or electronics integration. But it's good to remember that there was a time when the digital printing world was still new, and only a handful of people understood or even saw that it had a future — and realized that it would take more than seven days.

That was that; end of story. But then there was inkjet... DG

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