Book-on-Demand Market Pursues Affordable Run of One

The business of unit-run digital book printing, at a store near you, has been experiencing fits and starts since the late 1980s. Eight years ago *(see Vol. 21, No. 16)*, this publication featured such dreamers as Don Lancaster of Synergetics, printing books affordably on his Hewlett-Packard LaserJet IID. Back then, we wondered whether this was a marketable solution. But about three years ago, we stopped asking that question. Duplexing workgroup printers and color printers shot down in price, and companies such as Sprout, On-Demand Machine Corp., and InstaBook began to show that it was no longer unrealistic to think about small storefront book printing. In retrospect, 1998 was the year that this functionality matured. We now believe that 2000 is another threshold, because large interests at the content side are beginning to take action and drive further development.

The most obvious issue now being raised is the cost per book. So many variables come into play, for such a broad array of divergent plans, that it may prove far more difficult to fix on general pricing for an on-demand book than for an offset-printed product. One major bookseller recently suggested that the printing cost it was working toward, for a 6×9-inch 300-page trade paperback on decent stock, was around $5 per book. (To this would be added shipping charges from the printer, royalties and distribution markups.) While many vendors have been pushing the consumables costs well below $2 per unit for such a book—and some near $1—various costs and unknowns, including higher labor per unit and indirect charges such as rent and equipment, seem to confirm the suspicion that the smaller the solution, the less profit there may be in a $5 book. An added factor is the "chicken and egg" problem: How many facilities need to be operational before the first dollar is realized, and how does one finance those facilities until that time?

This article provides a summary of many of the machine solutions at each step in the book-on-demand process, examining each in terms of neighboring steps in the process. We will be paying particular attention to how the high-end solutions contrast with the small-scale projects.

Big plans, little plans

There are two distinct philosophies of on-demand book printing, which we shall loosely characterize as the centralized or big-system model and the distributed or small-system model. Both philosophies acknowledge that conventional book production is economically preferable for runs of more than 2,000 copies.

The centralized model. The first school subscribes to the basic notion that the high expense of a centralized system will be justified by large numbers of orders. This has particular appeal for established companies looking to transition into short-run book printing.

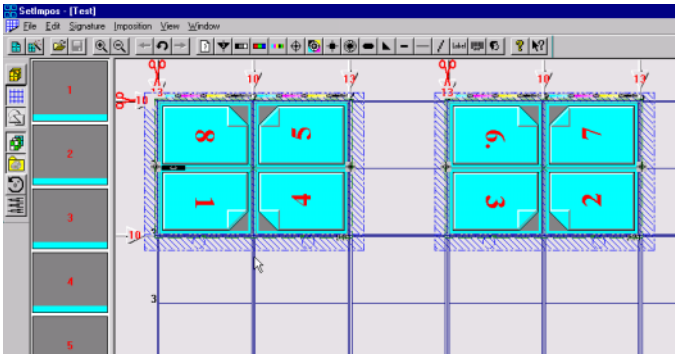
Book Stacks. Books from large and small book-on-demand systems. Can any of these practitioners get the total cost for a 300-page book down to about $5? Books in the left-hand stack are not laminated and exhibit some wear at the corners; at the right are laminated books, with minimal wear.

This scenario has been played out primarily in competition between IBM and Xerox, with the classic practical example being IBM's partnership with Ingram Book Division to form Lightning Print, now known as Lightning Source. Océ also made an appearance this year at BookExpo America with its DemandStream technology, similar in operation to the IBM InfoPrint platforms but with a lower price tag. Another recent entrant in this realm has been the Israeli company Aprion, offering an interesting drop-on-demand ink-jet solution whose speeds rival (and in some cases exceed) the several toner-based solutions.

The basic premise of the large model is that an already-established printing or distribution operation, given an investment hovering around $1 million, can acquire equipment that is practical for runs of very short lengths, typically requested by a bookstore or chain. The books are printed in and distributed from a centralized facility. The drawback to this approach is shipping cost; the book must be shipped from the central point to the distribution location, a step that can add $2 or more per book for very short runs or narrow distributions. On the other hand, the cost falls to perhaps only 50 cents per book for a larger quantity. This redeems the central-facility model for many bookstores: Assuming they order a selection of different books, they can save greatly on shipping costs if these books are coming from a single facility.

The distributed model. However, a second school of thought prefers to push the manufacturing process out into the bookstore itself or into a quick-printing shop. The premise is that the customer will order a book over the Internet and later drop by a convenient local outlet to pick it up. Alternatively, a buyer might select a book from the bookstore display; a new copy of the book immediately begins its life in a back room a few feet away.

IPTech ImpozeIt. There are many good imposition products available, but the bookstore of the future will need something completely different. If book printing is to be fully automated, the user interface becomes obsolete and its overhead may be considered a burden.



Because of their costs, this model is not practical with any of the highly visible large-scale systems. But it may be practical with the smaller products that have tended to frequent both BookExpo and the graphics shows over the past four years: Sprout, On-Demand Machine Corp., and cluster-printing systems from T/R Systems and ENTIRE. Since this is a concept even more in its infancy than the large-scale solutions, some companies are both appearing as system providers and also attempting to operate the print network until the market gains ground, as in the case of Sprout.

The ultimate promise of this second, "small is beautiful" proposition is based in its unit-run philosophy: A single product can in theory be manufactured while the customer waits, or can at least be picked up near the customer's point of ordering in as little as a few minutes'. We are not talking about a comb-bound or saddle-stitched product, nor one that allows only black-and-white covers. Today, the books coming off of these machines must satisfy customers' and publishers' conception of a quality book—it must be at least perfect bound with a color cover, and that cover must usually be laminated.

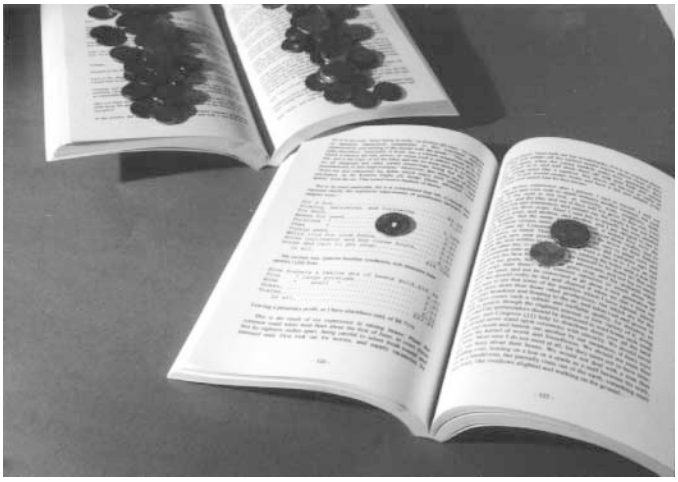
Every detail different. The large and small philosophies, from a strict manufacturing standpoint, might be viewed on a continuum. But there are radical differences in the way the large-scale and small-scale solutions must operate, and this plays out in such seemingly inconsequential hardware details as imposition, paper handling and consumables management, and lamination and other finishing matters.

In fact, one can look at it another way: Given that the key difference between a sheaf of digitally printed paper and a true book is that the latter is properly and economically bound with a color cover, the devil *is* in the details, specifically for the printing and finishing process. In other words, value over and above mere laser printing is achieved almost exclusively through the professional binding of the product. Therefore, the two schools need to approach each problem in different ways.

Imposition issues

At the high end, the economics of roll-feeding systems from Roll Systems and Stralfors make it crucial that the printers they attach to use as much of the paper as possible. One would never start

Grain matters. The grain of the paper in the foreground book is parallel to the spine. In the background book, it is perpendicular to it. The difference in the amount of force required to hold each book open is substantial.



with an 18-inch roll of paper and not print 6×9-inch books (the classic size for trade paperbacks) three abreast. When a mile of paper is passing in a matter of minutes, this does make a difference. But what about on small systems? If we are happy to print 50–100 books a day, which is a commonly cited figure for storefront printing, does paper economy matter as much as with the large systems?

Even in the "concept car" days of storefront equipment, developers were concerned with the cost per copy. They went so far as to take the question down to "thimblefuls of toner," as one practitioner has put it. Still, hard practical numbers have been somewhat scarce.

The economic problem for the smallest systems lies in the fact that most of them are designed to operate on toner-based printing engines in the workgroup category (the 20- to 40-ppm range; see below). Most of these printers are seemingly ideal for book-on-demand printing, until one attempts to economize on paper. For an 8½×11 inch book, there is zero waste of paper using a U.S. letter-size sheet. (This corresponds to "quarto" size in old printing terms.) But this size, commonly associated with magazine production, is rarely used for today's bookstore books; most trade paperbacks are printed at a standard 6×9 inch finish size. Interestingly, the 5½×8½-inch size is becoming increasingly common in the independent press, probably because some of them began as self-publishers, making saddle-stitched products. (In old terms, these are in the "octavo" scale. This also covers the mass-market paperback, a product of yet another size and aspect ratio.)

Against the grain. Some printers believe that it is still economical to print a book of any size on a letter-size sheet. This is tempting, because it eliminates concerns about switching to grain-short paper for two-up imposition. Paper grain direction is an all-important factor in book printing. The grain of the cover and the book block must always run vertically, parallel to the spine. For a perfect-bound paperback, the cover will hinge better and the inside pages will stay open more easily. Overall, the book will retain its shape better. An improperly finished book may exhibit a wave in the sheet and general warpage through the body of the book, and the book may not stay bound as well or as long.

The argument against imposition has merit because a unit-run facility may need to include varying sizes of paper, in different grain directions, in order to optimize paper use.

A typical paperback book printed two-up on a sheet would mean that the long sheet grain must be in the short direction, so the finished product will end up in the long direction. For a unit-run book-on-demand operation, it is inevitable that virtually every book will emerge from the assembly line followed by a completely different book, of a completely different size. The argument against imposition has merit because a unit-run facility may need to include varying sizes of paper, in different grain directions, in order to optimize paper use. To make matters worse, paper mills will not always be able to pass on the same economy for one common sheet sold grain long and the same size sheet grain short, though we have seen that a savings can be realized in most cases if one takes advantage of such opportunities.

Invisible imposition. Those who have been surveying imposition solutions are finding that most products are tailored for large-format, operator-intensive prepress departments, replacing the stripping room in most shops. These products, particularly the three largest contenders—ScenicSoft Preps, Ultimate Impostrip and Farrukh Imposition Publisher—all have reached a high level of maturity. But this is far more firepower than a small storefront book facility could ever require. The small "booklet" solutions, beginning with PageMaker's humble "Make Booklet" extension and including such products as Vision's Edge Bookletizer or DK&A's INposition, come with a limited number of canned layups and often do not provide for robust perfect-binding imposition control, which can be different from saddle-stitching.

In fact, it is probable that a unit-run storefront book operation, if it is to be profitable, will not enjoy the luxury of allowing an operator even to think about imposition. The greater likelihood is that imposition, if it does happen, will need to be automated and built into book-on-demand print spoolers. This means that the user interface may be completely unnecessary, and a developer may only require the ability from his spooler to call the imposition package at a command line, passing it various arguments, or perhaps calling the imposition engine's DLL.

Finding Paper Grain

In papermaking, grain refers to the alignment of cellulose fibers in the paper. It is a crucial variable in all aspects of printing, folding and binding. A sheet of paper is stiffer and more durable across the grain, more flexible and curlable with the grain.

You can easily check the alignment by folding a sample sheet. First fold it in half lengthwise; then unfold it and make a widthwise fold. Examine each crease closely. The fold that's aligned with the grain will be smoother. Another test is to tear the paper in each direction. Going with the grain, you can easily tear a fairly straight line; across the grain, the tear will tend to wander. A third test is simply to flex a half-ream or so; you'll note more springiness in the cross-grain direction.

Of the many mature imposition products available at Graph Expo, the large vendors were not quite as forthcoming with this ability as were two smaller players, IPTech (formerly IPT, San Luis Obispo, CA) with its ImpozeIt, and Quebec's Dynagram with its DynaStrip. The programmers for both of these products were on hand at the show, and they pointed out that it would be trivial for any print spooler automatically to write a set of rules and call their engines, jettisoning the user interface. Their business people suggested prices well under $1,000 per installation for such a capability. This begins to approach the required cost for such a component on an inexpensive storefront system. Other products, such as Aandi Inston's Quite Imposing (www.quite.com), were not on hand at Graph Expo, but, in theory, any imposition engine should be able to attach to a hands-off book-on-demand workflow.

Engine and toner issues

There is something to be said about a DocuTech's reliability, and in an environment in which tens of thousands of impressions are to be made daily, there may be no more ideal solution. (The cluster printer people may justifiably differ in this opinion.) But in the market stratum just beneath the 100-plus-ppm web-fed and sheetfed powerhouses—below the Xerox DocuTechs, IBM InfoPrints, and Océ DemandStreams—lie a variety of products that carry the same reliable names, and they could be the answer for the storefront. Their footprints and price tags certainly seem better scaled to the cottage-sized printing plant.

Nix on clicks. These Xerox, IBM and Océ machines all have model numbers that confound them with the high-speed units of their line, though the architecture is far different. Alongside them are similar products from Konica, Hitachi, Minolta and Canon. Whether the consumables for these systems—either from the OEMs or from third parties—are competitive enough for unit-run books is not yet clear. Certainly, with standard "click charges" on a DocuTech or other similar solution, getting the full factory price of a 300-page book down to $5 will be very difficult. One Océ owner put it very bluntly, saying, "At a nickel a copy, I can get $15 for 300 copies," without the need to impose, bind, or otherwise manage the product. "Now you're telling me I can only have $5 and I need to do all that other work?"

Many are saying it can be done, but, to do so, they all have forced themselves to escape from the "click charge" mentality. Many factors are brought to bear, and there appear to be hundreds of ways to answer the question. One happy T/R Systems customer, The WordPro of Ithaca, NY, is printing 1,000 books per day profitably. Jane Kalter and her husband Robert, among the earliest T/R cluster customers, are using their MicroPress 024 machines to print books on demand.

The 024s are built around the Canon WX print engine, the same one used in the HP 5Si and 8100 workgroup printers. For consumables, the Kalters go to neither Canon nor HP, and they also avoid the volume toner remanufacturers, opting for Hitachi OEM toner cartridges, which work in the Canon engines. That these

DemandStream and Hunkeler. In the showroom, a Standard-Hunkeler cutter-trimmer at left attaches to the end of an Océ DemandStream Twin 8090. The 8090 comprises two units. In this configuration, the second unit follows a quarter-turn from the first. The system is producing 8.5×11-inch book blocks, shown emerging at left in offset stacks, ready for offline binding.

The Art of Golf. This book cover was imaged on a Xerox DocuColor laser printer. Though the result is certainly not invincible (note the wear at the corners, even with gentle handling), it is among the most scuff-resistant media we have seen taking toner.

and most of the other workgroup printers use a single consumable drum-toner unit does not seem to faze the Kalters, who buy these cartridges in pallet quantities from Hitachi. For them, economizing on toner is a top priority, as long as they do not compromise on quality.

Clusterable. T/R Systems has opened up its cluster environment with its Maestro solution, allowing connectivity to many other printers and not requiring that printers be bought from them. AHT/ENTIRE, the other high-profile cluster company, also supports third-party printers. This is timely, since the field of 20- to 50-ppm clusterable workgroup printers is growing even faster than the higher range.

Even Xerox has entered the game for lower-than-DocuTech speeds, offering its DocuPrint "N" series printers through a distribution channel. But while their lowest-end desktop printers sell like hotcakes at the warehouse clubs and office supply stores, it is very difficult to find distributors selling the middle ground of Xerox workgroup printers.

Other manufacturers, including Kyocera, seem happy to take advantage of Xerox's and Hewlett-Packard's megalithic consumables-pricing and channel problems. For around $3,100, Kyocera/Mita sells its DP-3600 workgroup printer, which uses a large bulk-toner consumable and has a separate drum, easily replaceable by the operator. This allows Kyocera to show a much lower per-impression cost than HP or Xerox. Kyocera, a brand virtually unknown in the U.S., does $8 billion in sales in Europe. While from an engineering standpoint this machine appears to cut corners (the stamped metal and cast plastic parts are of a thinner gauge than is typically seen on more expensive printers), we have heard glowing reports from some users on its reliability.

Xerox shows three solutions

Xerox was found in the Lakeside Center building at Graph Expo. Although until recently this building constituted all of Chicago's McCormick Place and was the largest convention center in the country, this year Xerox occupied the entire building. Dimly lit, and seemingly chaotic and noisy, it was difficult to separate one DocuTech application from another. There were a number of book-on-demand solutions with various specific aims; some were tailored for catalogs and some were for books. But, as always, Xerox's exhibit was where we learned the most about how to handle on-demand cover printing and finishing.

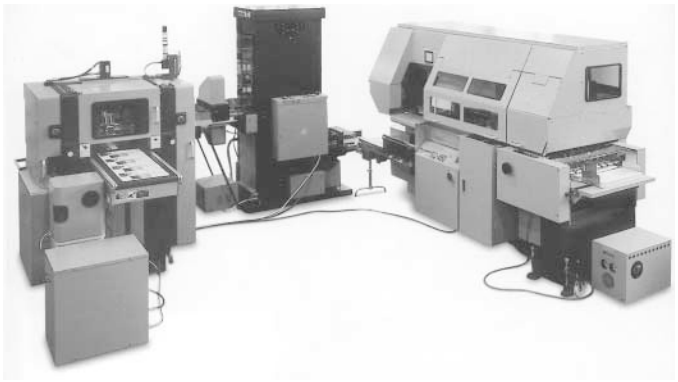
A high-end system. At the high-volume end, Horizon, a perennial partner in Xerox's sheetfed-finishing efforts, was showing what may be the first-ever fully automated end-to-end system for perfect-bound books on demand. The most difficult point in the workflow is getting a cover, printed on a separate printer, wrapped around the proper book block. Horizon's system begins with a Xerox DocuTech 6180 for printing the book block and a DocuColor 40 for printing the cover. (No lamination is done on the cover.) The block runs into the Horizon IF-340 Accumulator and, after collecting and jogging, proceeds into the BQ-340X binder where, standing on its spine, it meets the color cover coming inverted out of the DocuColor.

The bound book now moves upon its back along a conveyor, through a cooling tower, and finally into an inline HT-30 three-knife trimmer. Theoretically, no human hand need touch any part of the product from the time the customer places the order to its completion.

This system may be even more complex in nature than Ray Kroc's famous, vain attempts at the automated hamburger assembly line. Regardless, billions could be served in this way before the lights turn out on the printed book. But the system costs well over $1 million, and it produces a very expensive book, thanks to its one-up imposition and Xerox's pricey toner. Books from this device will not likely reach our $5 mark. Furthermore, the Horizon BQ-340X binder requires a 15-second hold time. Given that configuration, any book longer than 45 pages will cause a bottleneck in the system at the printer. (Fortunately, the catalog being demonstrated at Graph Expo was very thin.) A lot of bugs will need to be worked out of this process. But at up to 240 books per hour, hands off, this is an amazing step forward.

A roll-fed system. A separate Horizon assembly line was set up for printing trade paperbacks. This was fed by a Standard Hunkeler SF-4 roll-to-sheet feeder, which takes as input an 11-inch reel and converts it on the fly to 8½×11-inch or 11×17-inch sheets, feeding it into the bottom of a DocuTech's Tray 3. The precision of the trimmer, it is claimed, will "eliminate the need to three-side trim perfect-bound books," but we think the entire assembly line would have to be equally tight in tolerance to make good on such a claim.

Standard BQ-460. Xerox has teamed with Standard, C.P. Bourg and others for head- and tail-end paper handling. At Graph Expo, Xerox and Standard premiered this BQ-460 finishing system, which features (counterclockwise from right) the BQ-450 binder, moving into an SL-40 dwell tower for cooling the adhesive, and finally into an HT-30 three-knife trimmer. This equipment is fed by an operator.



The advantage of the Hunkeler SF-4 roll-feeding system is that it permits up to 40,000 continuous sheets between roll changes. But it's not perfect. The books produced on this system at Graph Expo exhibited a noticeable warp, perhaps because books were coming fresh off the roll. Several days later, the warp was less noticeable.

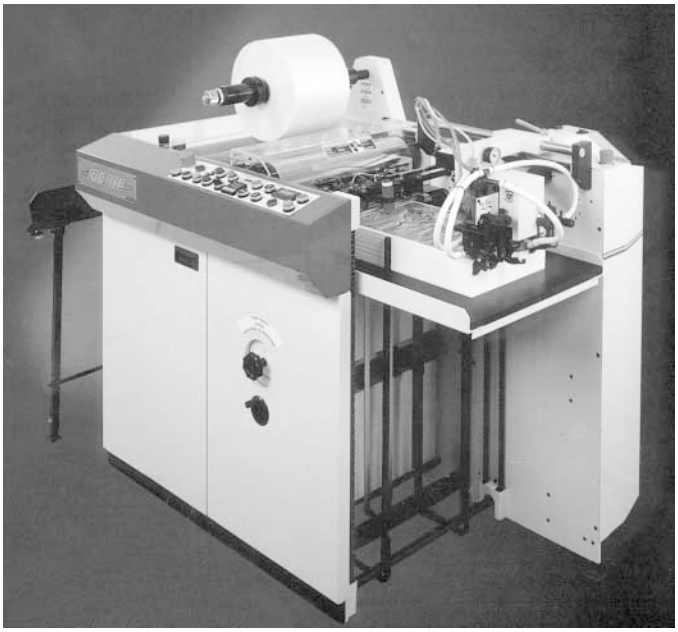
This assembly line had a break where the books came out of the printer. There, Horizon showed off a manually fed finishing line combining its BQ-440, an SL-40 conveyor/cooling tower, and an HT-70 three-knife trimmer. The three units together list for just under $200,000, providing a theoretical maximum production speed of 1,000 books per hour. But with blocks manually fed, this would require an operator to load a book every 3.6 seconds, which is possible but not for sustained long periods. Solutions include slowing down the line and having two operators, each feeding every other book.

Book Factory. C.P. Bourg, another Xerox finishing partner, showed the Xerox Book Factory, which is being used by the Graphic Arts Technical Foundation. It has been touted as the first-ever digital-book-publishing solution using the Job Definition Format (JDF), the new Adobe-based standard for print product specification related to the Fraunhofer Institute's CIP3 specification. What this means is that a PDF file could be sent from a remote location with all the media and finishing specifications included and, assuming the Xerox system supported the specified finishing options, the product would emerge from the printer as requested, possibly as a completed product. At the show, covers were being manually fed into this system for some reason. But it appears to have equal potential with the Horizon system to be completely automated, and its literature suggests it has that capability.

This system appeared similar to previous Xerox-Bourg offerings, right down to the BB 2005 perfect binder, but with one difference: the relatively new Perforate-Rotate-Fold unit, or PRF. This unit takes each 8½×11-inch sheet emerging from the DocuTech, printed two-up, then does just what its name says it does: It perforates, rotates and folds the paper.

Two problems arose in this workflow. The paper used was grain long and two-up, which left the finished books grain short. In addition, there was no provision for lamination, which, coupled with the spring-loaded tightness of the grain-short pages, caused the spine to crack and the book to break open. While some cover stocks come close to requiring no lamination, the one Bourg was using should have been laminated before binding. Given a more resilient spine, it may also have kept the books from cracking open.

GBC Orbit 2000. GBC's new production laminator accepts a patented nylon media that is applied to one side of a book cover or book jacket. After laminating, the cover passes through a tight bend, breaking the fibers in order to additionally retard curl in the cover. In single-sided lamination, a continuous path of media must be maintained.



Tek for covers. Tektronix, recently acquired by Xerox, was buried behind other partners and difficult to find. But its Phaser 780 printer, whose street price is around $7,000, may be one of the ideal machines for low-priced unit-run covers on demand. It is able to support 13×19-inch sheets, though only through the manual feeder. This is an important point to make, since a book whose finished size is 8½×11 inches and is one inch thick will require a cover design at least 18 inches wide. According to Tektronix, the price for a cover printed on the Phaser 780, not including paper, would be 41 cents at 35% ink coverage—probably a little bit high of the mark for a $5 book. Tektronix added that the maximum of 400% coverage would probably cost about $1.50 to $1.75 in toner.

We did manage to convince Tektronix's marketers that the thermal wax-based printers, whose ink characteristics have always made them the ideal design-proofing device, simply cannot be used for book covers. At first, they were unconvinced, so we took sample prints from a Phaser 750 "solid ink" printer and ran it through GBC's laminator. The result resembled a crayon drawing run underneath an iron—which is exactly what it was—and we were lucky that it did not damage GBC's laminator, because it is not clear who would have been liable. Tektronix wisely buried the results in a cabinet. Book-on-demand covers may be produced with dye sublimation, xerography, even ink-jet technology—but they will never be done with thermal wax.

Lamination, binding and trimming

GBC's Orbit 2000 laminator was used in the finishing section of Xerox's roll-fed trade paperback book demonstration. It represents

Marsh trimmer. **The $25,500 Perfect-Trim from March Technologies cuts three sides of a paperback book with a single blade, by rotating the book into each of the three positions.**

fundamentally the same concept as the earlier Eagle 35 OS tabletop laminator, but this unit is more robustly engineered. The idea is simple: it uses "lay flat" nylon heatset lamination film on a 60 pound cover stock, applied only to one side of the paper; after lamination, the back of the cover is swaged around a sharp corner, breaking the fibers in the paper. This provides for a relatively (but not completely) curl-free one-sided laminated cover.

This solution's strength—one-sided lamination—is also its drawback. It means that a continuous stream of covers must be passing through the machine; if the stream stops, the lamination film will have nothing to stick to but the pressure roller after the last sheet passes through, leaving adhesive scum on the rollers. This will not work in an intermittent storefront workflow, during which there may be some time between production of one book and the next. But it will work in large runs, as long as all sheets are the same size. We assume it also could work with a roll-fed color printer like a Xeikon or an Indigo system, but we have not seen it used in that context.

The nylon material is the subject of U.S. Patent No. 5,626,969 held by Luis Joson, a 23-year veteran engineer at GBC. The idea is that nylon is less flexible and has moisture-absorbing properties that are similar to paper. This, along with the back-breaking, makes for a flatter cover than standard polyethylene or polypropylene media, which are far more subject to the effects of humidity. According to Tom Snooks, supplies product manager at GBC, polyethylene, even after the backbreaker, will only stay flat for one to three weeks. "In Houston," he chuckles, "it'll end up curling in a day."

Spage-age trim. Jeff Marsh scoffs at the idea that book covers must be single-side laminated. Indeed, reason would suggest that both sides laminated would be better than one. "It's only because the glue doesn't stick" to the spine that we must laminate only the outside, Marsh explains. He has experimented with abrasive and chemical solutions and produced a cookbook whose cover, he believes, is indestructible.

But Marsh, one of the minds behind On-Demand Machine Corp., is more concerned right now with how to handle the rest of the finishing aspects. His company, Marsh Technologies of Chesterfield, MO, appeared at Graph Expo with a very interesting new product that could turn three-knife trimming on its ear. At first glance, the $25,500 Perfect-Trim, with its space-age whirring robot-arm electromechanics, stirs doubt. But the machine grasps a printed book gently and cuts with a single blade, moving the book into position on all three sides. One key advantage is that there is no clamp pressing down on hot-melt binding glue that has not yet cured. This eliminates the need for the dwell stages seen in the Horizon and Bourg solutions. The other major advantage is that a single knife station is used instead of three coordinated blades provided on the high-end solutions. This is much slower, taking about 30 seconds total, but there is no doubt it can keep up with a very fast print engine.

Aerodynamics. Marsh, an auto industry engineer who did stints at Bendix and Kelsey-Hayes, where he worked on ABS brakes and supercharging systems, admits that book production is trickier in some ways. "But it's different," he said. "It's aerodynamics, you know." Marsh was referring to the way paper must move through the bookmaking process. His BookBuilderOne, produced with Harvey Ross and ODMC *(see Vol. 28, No. 17)*, contains what he describes as an "Asian ripoff" of a Bourg tabletop binder. Marsh stripped all but the internal organs of the binder, and extended the binder's rail far past the nipper table into his own trimming mechanism, very similar to that seen in the Perfect-Trim. Additional electromechanics, coupled with a software control interface, complete a machine that does what several pieces of Bourg and Horizon equipment do for the Xerox line, but for a tiny fraction of the cost. This may be a good choice for Sprout and others who currently finish books manually and need an inexpensive solution.

Aerodynamics aside, Marsh also reiterated that his dry ultrasonic binding technique could be an important step in eliminating the "fluid dynamics" problem of hot glue systems. The glue will be applied as a powder or trimmed from a flat sheet to match the spine. The spine will then be subjected to a high-frequency vibration, melting the glue and fusing the block to the cover.

What Marsh is still working on is the process of getting the book block from his QMS laser printer into the binder, and of getting the cover into the binder in a similar fashion. The crux of the problem lies in getting the paper across the threshold of one machine and neatly into the binding system. For a Xerox line, this maneuver costs six digits to achieve. If anyone can bring this down to a few thousand dollars, it will be Jeff Marsh, perhaps with the help of Victor Celorio, another engineer applying himself to this problem. Celorio's InstaBook, which does two-up imposition and automatically passes the block into the binding mechanism, was described in detail in May 1999 along with the ODMC solution *(see Vol. 28, No. 17)*.

Siamese bind. Another unique combination solution is the Doubleback binding system, developed by Book-in-Hand of London. This system takes two-up printing to its logical conclusion, allowing two books to be bound simultaneously while still attached at the outsides like Siamese twins *(see the Seybold Report on Internet Publishing, Vol. 4, No. 11)*.

Foil books. At left is a document cover run through a Powis Parker printer. Though no "sock" impression is made, the foil holds well to the material and any design is possible. Powis Parker reports no plans to apply its technology to case binding. At right is a book made on the Flesher Premere, a true impact foil stamper, whose only disadvantage for books on demand is its finite design gamut.

Storefront scale. Beyond these three solutions, what exists at the low end are the manual components for each step in the process. For those using laminators, the smaller USI, GBC and Seal laminators are common. A Seal one-sided laminator, also sold through USI, has an adjustable cutting wheel that can trim the width of the roll to any desired size—but the user must still ensure a continuous feed of sheets, as with the other one-sided solutions. Daige (Albertson, NY) has been experimenting with coating book covers with varnish. Many developers are simply skipping the lamination step for the time being, opting for papers that look laminated, but this does not give the product the same protection as lamination.

Binding machines toward the storefront end of the scale must be relatively small, single-station products with wide-open access for manually loading in the book block and the cover. There are many of these quick-print binding machines available from Rosback, C.P. Bourg, Standard, Duplo, Sigma and Planax. The primary differences among them lie in the small details, such as whether the spine is ground before binding. Most of these machines do a grind, but the Standard Bind-Fast 5 does not. But the Bind-Fast 5, because of its simplicity and manual control, offers better access to line up a book for the possibility of unit-run binding. All of these units range between about $4,000 and $20,000.

The very compact tabletop units include the Horizon BQ-P6 and a new Taiwanese unit called "i-binder," being distributed by Brackett of Topeka, KS. The basic unit is almost identical to the Horizon in shape and size. The problem for trade paperback binding is that it is more limited than the larger machines in the spine thicknesses it will accept, though the i-binder II reportedly will bind books up to 1½ inches thick. It is unknown how these might stand up in volume production of on-demand books. (Additional discussion about on-demand short-run bookbinding, including cold-glue and adhesive strip binding solutions, appeared in Vol. 24, No. 4 of the *Seybold Report*, though some of those products are no longer offered.)

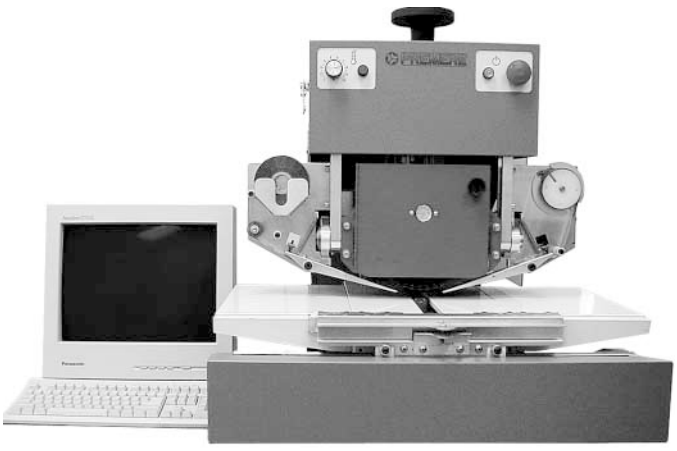
Trimming the book after binding, except in the cases mentioned above (Marsh Technologies' BookBuilderOne, the Book-in-Hand Doubleback and the various three-knife solutions) is a mostly manual process governed by a basic single-knife trimming machine. There are a number of small tabletop trimmers available from companies like Triumph, Ideal, and EBA (all sold by MBM), Challenge, and Martin Yale, with varying degrees of automation. But, in some cases, the added automation can be a hindrance to manual control; if an operator wants to "eyeball" his way to a position, it is more difficult with any system that has buttons instead of manual controls. Too, punching buttons in some cases can be more time-consuming than manual handling.

At the fully manual end, we have found three straightedge guillotine trimmers capable of finishing books of average thickness: the Triumph 3905 and 4700, the EBA Multicut and the Martin Yale 7000E. But while the price for these is close to a storefront or quick-print budget, some operators may have difficulty trimming books greater than about one inch thick, though they can all accept books up to 1½ inches.

Case binding for ultra-short runs and unit runs

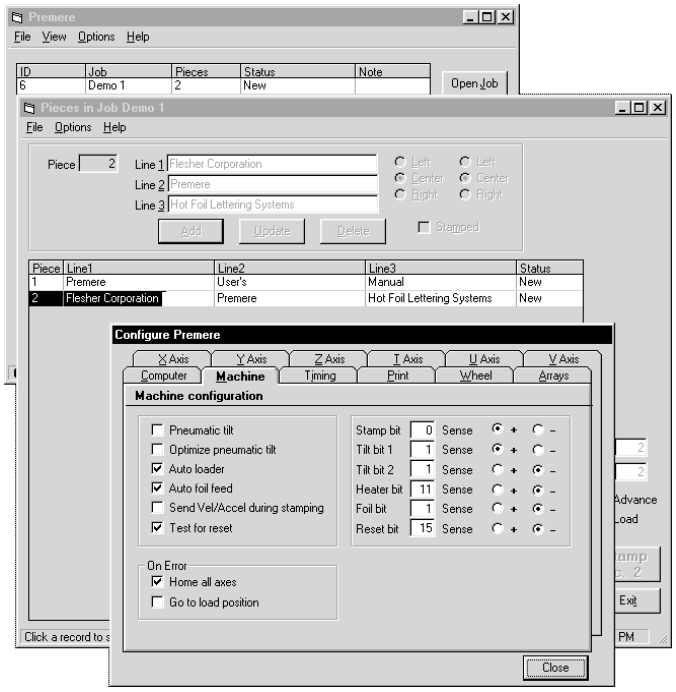
John Jacobson of On-Demand Machinery in Elizabeth, NJ (no relation to Harvey Ross's ODMC) appeared both in the Xerox pavilion at Graph Expo and in his own booth in the main building. His small case-binding equipment line has been around for several years, and many extremely finicky bookbinding customers have purchased the system. It costs approximately $70,000 and can case bind up to 100 books per hour, depending on the number of operators. At the Xerox booth was Jacobson's casing-in machine, but in place of his own casemaking unit was the SC-1 automatic casemaker from a company called GP^2 (pronounced "GP-squared"), which reportedly can produce a case every 20 seconds.

Possibly the most exciting product in Xerox's case-binding corner was a binding cloth that can be run through color laser printers. Priced at 75–80 cents per sheet, ICG Holliston's DigiTex



Flesher machine. The Flesher Premere 200 uses standard foil-stamping ribbon and can automatically produce a book cover in a matter of seconds.

Flesher setup options. Flesher's software permits extremely detailed control of its robotics and also allows any book cover jobs to be stored in a list for future access. While there are limits to which it can be automated, the software kernel is prepared to adapt to almost any workflow.



material has incredible toner adhesion, better than virtually any paper we have seen used in book-on-demand printing. Truly, lamination is neither required nor welcome. At sharp corners, toner does tend to wear off more easily than on offset-printed or colored binder's cover cloth, but this stock is a major step in the right direction for case binding. Images are crisp with detail; whites are white and blacks are black. This material was run through the SC-1 casemaker and finished on Jacobson's equipment.

Giant Selectric. At Jacobson's booth on the main floor, Flesher's Richard Bruce demonstrated the impressive Premere [sic] foil-stamp lettering machine. It is computer-controlled and highly customizable; the reader should imagine a giant IBM Selectric Typewriter (sorry, no correcting allowed) with a huge typeball and colored-foil ribbons. This device is ideal for on-demand foil-stamping of book covers and other short-run or unit-run products. "Nobody else has a computer-controlled individual character stamping system," says Bruce.

The development of these unique machines dates back to two decades ago when Flesher, based in Colorado Springs, CO, developed a system operating under MS-DOS. This has evolved into units with 100, 200 or 300 character positions, each rotatable in 90-degree increments on the wheel, and each programmable. The Windows interface allows job management to such a degree that, theoretically, this machine can be fed commands automatically from a queue and produce unit-run books on demand in a storefront venue.

Cartridge color. Powis Parker, hailing from Berkeley, CA, showed its FoilFast printer, based on the Alps MD series of heat-activated cartridge color printers. Instead of CMYK color cartridges, the Powis Parker systems are loaded with foil-stamping colors and opaque white.

The advantage of the Powis Parker system is that any computer graphic may be imaged, not just a limited set of characters on a typewheel. The disadvantage is that there is no authentic "sock" impression into the material, as with traditional foil stamping and with the Flesher system. You also cannot image onto real binder's cloth as you can with the Flesher system—the FoilFast admits colored vinyl sheets.

On the other hand, Flesher's gamut of characters and graphic devices is limited to what can fit on the wheel and what can be custom-milled to order. What may be needed is a hybrid between these two: perhaps a dot-matrix unit that can produce any image on any material with real foil-stamping media. Does such an animal exist?

Conclusion

The high-end contenders are showing that they are very near to mastering short runs of books on demand. Océ DemandStream, IBM InfoPrint and Xerox DocuTech systems with C.P. Bourg, Horizon, Stralfors, Roll Systems and other attachments now can do what was nearly impossible ten years ago. Still, the cost per unit is too high for many applications, and, worse yet, it is not yet certain how the equipment costs will affect the unit cost. Unit-run printing and its distribution logistics still seem unlikely on the high-end platforms. Such levels of automation on a show floor are one thing, but, in practice, many people are continuing for the moment with manual finishing processes.

At the low end, ingenuity and a thrift ethic are continuing to make strides, though these efforts are not as well promoted as the higher-end projects. Companies are beginning to find reasons to partner to solve these problems, though it still seems a long way off. True automated unit-run finishing is still in the future.

At both ends of the market, experimentation with materials and handling is continuing, with some new and possibly conclusive solutions in substrates, media and paper-path and assembly-line management. In addition, case-binding solutions for short-run and unit-run books have advanced in materials and technique.

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