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PRINTING INDUSTRIES OF AMERICA

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THE MAGAZINE

TECHNOLOGY ● SOLUTIONS ● RESOURCES

FORECAST ISSUE

featuring the InterTech™ Technology Awards

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Publisher's Message

Welcome to the fall *Forecast* issue of *Printing Industries of America: The Magazine,* highlighting timely business and management topics, important environmental and regulatory issues, and the latest technology trends in the print and graphic communications industry.

This year, we are proud to once again feature the InterTech™ Technology Awards recipients as an insert in our magazine. Since its inception in 1978, the InterTech Technology Awards have had a remarkable knack for identifying and highlighting nascent technologies with a promising future—a point demonstrated by the fact that more than 85 percent of recipients experience commercial success. Because of this, we feel that including the InterTech Technology Awards brochure, with its detailed descriptions of every technology submitted for consideration, aligns perfectly with the goals of this forecast.

In addition to learning about the InterTech Technology Award recipients and candidates, you will also gain awareness of trends and developments affecting graphic communications in the **Industry Insights** section. Next, the **Environmental, Health, and Safety** section covers tips for protecting your company and positioning your brand as a leader in sustainability issues. Finally, the **Technology Trends** section examines the nuts-and-bolts side of the industry and offers predictions about new tools poised to enter the market.

Would you like an opportunity to network face to face with some of the key innovators behind the award-wining technologies featured in this issue? If so, plan on attending the **Premier Print Awards Gala featuring the InterTech Technology Awards** on **September 25, 2016,** held in conjunction with GRAPH EXPO 16. For more information, email Mike Packard at mpackard@printing.org.

Thank you for reading,

Julie Shaffer

Julie Shaffer
Vice President, Education & Marketing
Strategies, Publisher, *Printing Industries of America: The Magazine*

WELCOME

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CENTER FOR TECHNOLOGY AND RESEARCH

Do you have a new and innovative technology that should be considered for a **2017 InterTech Technology Award?** For details on how to apply, visit **www.printing.org/InterTech** or contact Jim Workman at intertech@printing.org. **The deadline for entries is June 2, 2017**

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iLEARNING CENTER

MARKET CHANGES
IN PRODUCTION WORKFLOW

Jeff Weldon, *CDIA+, Senior Analyst, Madison Advisors, Inc.*

THE WAY OF THE FUTURE

In the past, if you wanted to create an integrated, multi-step workflow, the solution would involve utilizing software from multiple vendors and applying two levels of programming in the workflow engine—one to integrate all of the components into your workflow and then another to update requirement changes, often resulting in a costly process.

A recent shift in the business mindset now allows users—rather than IT programmers—to define and implement a workflow using standard building blocks. Software suppliers are responding to this trend, and, as a result, several companies are offering products that incorporate advanced customization into the workflow management process, such as drag-and-drop features, code reusability, detailed metrics reporting, and more. These advanced features allow for greater flexibility for the user and help satisfy a broad range of customers.

WHAT'S BEHIND THE SHIFT TO AUTOMATED WORKFLOW?

The main objective of any workflow solution is to get output into the hands of a consumer as efficiently as possible. There are a number of processes that can be incorporated into the workflow that help achieve this goal.

As software applications have evolved, new ways have been added for them to be controlled by external programs. Users can now send commands to control the actions of different programs through the use of proprietary application programming interfaces (APIs), generic APIs (e.g. ODBC—open database connectivity), and other innovative mechanisms. These features have improved the ability to incorporate components from multiple companies into the end-to-end workflow and streamline the overall efficiency of the processes.

One area of improvement with this new functionality is decreased slowdowns in the print and insertion area at job changeovers. The process of changing paper stocks, adjusting inserter feeds and folders, and changing out paper inserts is a labor-intensive process, with short job lengths specifically requiring frequent job changes. Daily overall output capacity and cost can be significantly improved by using a production workflow system that creates long runs by intelligently combining multiple files together.

Piece-level tracking and accountability becomes more difficult when you combine multiple print runs into a single file, but new updates to workflow engines now allow users to track what jobs were rolled into which print files. Using data from the inserters and camera systems, the workflow managers can reconcile when a piece was inserted, providing true document lifecycle tracking. This same reconciliation data from the inserters allows the workflow system to automatically create a reprint file if needed.

Large files containing similar jobs offer an opportunity to save significant money on postage. Once the files are combined, running a postal sort over the resulting file can help categorize and group similar zip codes to streamline the shipping process, a function that requires mechanical sorting when using many small files. This step may also minimize the amount of output that ultimately goes to a mechanical presort vendor in order to qualify for a postal discount.

An additional workflow improvement can be found in switching from physical inserts to onsert pages. The same post-composition tools that combine files can also replace calls for physical inserts by printing the information inline on an additional sheet in the mailpiece.

While all of these technological advances help improve the workflow process, the main way to create larger job runs is with a white paper workflow. Longer runs require minimizing preprinted paper stocks. This can be done with a number of tools that allow the matching of stored background images with various page types within a document. So whereas you might have had multiple paper stocks in a job before, you can now print the background on each page on the fly, allowing virtually unlimited customization on each page.

However, just eliminating preprinted paper isn't going to allow you to combine a group of jobs into a single one, so logistics remain an important factor. You also have to think about address and barcode locations so that you can gain efficiency on the insertion side of the house. Fortunately, the tools that allow you to "flash" the page backgrounds also support document-reengineering functions that support adjusting address locations so they will all fit in a common envelope design. Also, any existing barcode symbologies can be removed and replaced with a single barcode for the entire run of multiple merged jobs.

THE BOTTOM LINE

Simply put, digital production workflow is all about getting the most out of your digital production equipment. There are many steps that go into a particular workflow, but in the end, the objective is to get information onto paper and off to a consumer. Regardless of the method of conveyance, the old school, single-step process was cumbersome, tedious, and resulted in printers and finishing equipment remaining at a standstill until the digital production workflow was executed for each job. Thankfully, robust tools and advances in workflow technologies have helped improve the end-to-end process of getting print jobs out the door efficiently as well as to reduce overall production costs.

About the author: Jeff Weldon is senior analyst at Madison Advisors, an analyst and consulting firm specializing in customer communication technologies including enterprise output management, content management, customer relationship management, e-billing, and infrastructure technology.

THE REVISED OVERTIME-EXEMPT REGULATION

PIA Staff

On May 18, 2016, the U.S. Department of Labor (DOL) released the final rule revising the overtime-exempt rules for employers across the U.S. The final rule contains some surprises, particularly a pullback of the proposed salary threshold and indexing of the threshold every three years instead of annually.

KEY POINTS OF THE FINAL RULE

The final regulation retreated on several key points made in the proposed regulation. These changes were mainly due to comments made by the public (including from PIA and many PIA members) and last-minute lobbying efforts by various industry groups. Key points of the final regulation include the following:

- The new salary threshold will be $913 a week ($47,476 a year), effective **December 1, 2016** for executive, administrative, and professional occupations. The current salary threshold is $23,660 a year.

- The Highly Compensated Employee (HCE) salary threshold will increase from $100,000 a year to $134,004 effective **December 1, 2016.**

- The final rule allows up to 10 percent of the salary threshold for non-HCEs to be met by non-discretionary bonuses, incentive pay, or commissions, provided these payments are made on at least a quarterly basis.

- A catch-up payment can be made quarterly to ensure a position keeps its exempt status, but the catch-up payment must be made by the next payroll after the quarter. An employer's fiscal year (and quarters) may be used instead of a calendar year.

- Annual indexing of the above salary thresholds will occur every three years beginning on January 1, 2020.

- No changes in the "duties tests" were made to any of the overtime-exempt occupation classifications.

- No changes were made to the outside sales employee exemption. Note also that there is no salary threshold for the outside sales employee exemption.

- The computer professional employee salary exempt threshold will change with the executive, administrative, and professional noted above. The final rule did not change the overtime-exempt option that a computer professional employee may be exempt if paid hourly at $27.63. Note, the duties test must still be satisfied.

DOL PULLS BACK A LITTLE FROM THE PROPOSAL: AN ANALYSIS

Salary Threshold: In reviewing comments submitted on the proposal, DOL decided on a lower salary threshold based on the 40th percentile of earnings of full-time salaried workers in the lowest-wage Census Region (currently the South). DOL initially proposed using *national* Census data to establish the salary threshold. The pullback to use the lowest-wage region data is a good concession. However, despite the reduction from the proposal, the increase in the salary threshold still represents a 100 percent increase from the current level.

The **Highly Compensated Employee (HCE)** salary threshold actually went up from the proposal (from $122,148 to $134,004). This salary threshold is based on the 90th percentile of earnings from the fourth quarter 2015 national Current Population Survey.

Indexing: Initially DOL proposed annual indexing of the salary threshold, but decided to index every three years beginning in 2020. DOL will provide at least 150 days notice of annual indexing updates.

Non-discretionary Bonus: For the first time, DOL is allowing **up to 10 percent** of the salary threshold (for executive, administrative, professional, and computer professional classifications only) to be met by non-discretionary bonuses and incentive payments (including commissions). Note, this bonus must be paid *quarterly* or on a more frequent basis in order to apply to the salary threshold. PIA suggests monthly. A non-discretionary bonus, incentive, or commission may actually be higher, but only 10 percent of the salary threshold (currently $47,467 or $4,746) may be applied in meeting the threshold with the bonus.

Catch-up Payments: Under the revised rule, for those exempt employees whose non-discretionary bonuses are needed to meet the new $47,467 salary threshold, the employer may make a "catch-up" payment at the **end of each quarter** if the compensation is not on track ($1,186.66 per quarter). However, this payment must be made by the *next pay period after the quarter has ended.* Failing to do so would mean the position loses its exempt status!

STATE LAW INTERACTION

Employers must still comply with applicable state laws on overtime exemption. Many states' regulations match those of the current 2004 regulation. California and Alaska's overtime-exempt rules specify the salary threshold is twice the state's minimum wage and then annualized at 40 hours per week. California's minimum wage currently is $10.00 an hour, which means the salary threshold is $41,600 (below the new federal salary threshold). However, the state's minimum wage was recently revised and will increase every year to eventually $15.00 an hour by 2022. This translates to a salary overtime-exempt threshold of $62,400. For more information on state overtime-exempt rules see **www.printing.org/page/3437.**

WHAT ABOUT PRINTING INDUSTRY CUSTOMER SERVICE REPRESENTATIVES?

In the proposed regulation, DOL asked the public for suggestions of additional occupations that could be written into the regulation as exempt from overtime under specific conditions. PIA, along with nearly two dozen members, submitted comments urging that DOL add customer services representatives under the administrative exemption since they normally exercise discretion and independent judgment during the course of their duties and often are given authority by management to "stop a job" anywhere in production.

Unfortunately, DOL decided **not** to add any exempt occupations to the regulation.

However, this does not stop a printer (excluding those in California) from taking the position that their CSRs (or senior CSRs) are exempt from overtime if they meet or exceed the new salary threshold and satisfy the Administrative Duties test. CSRs could be given authority (written into the job description) to "stop a job" based on their discretion and independent judgment for customer and/or employer quality standards. These exempt CSRs should know that they have this authority and should exercise it from time to time (although not too much, otherwise you may have operational issues). Others in the plant (supervisors, managers, team leads, etc.) should know the exempt CSRs have this authority and it should be reviewed periodically (e.g., annually). Documentation that exempt CSRs have exercised their authority is key as well. For example, a job ticket might be ideal for documentation. When this authority is exercised, HR should obtain a copy, ensure that it is clear as to the authority exercised, and put it in a file that will not be purged. You will need it if your firm ever has a DOL Wage/Hour audit and the CSR exemption is questioned.

A CSR job description that has passed a DOL field audit is posted on PIA's job description webpage, **www.printing.org/jobdescriptions.**

A word of caution: Note that even if the above suggestions are followed exactly, DOL field investigators may still come to a different conclusion. This has happened in the past, and despite the printing company providing evidence from previous DOL audits on the CSR exempt issue, there is no guarantee that the field investigator will see it your way. However, the more cases that go our way in the future, the better your chances. Plus, PIA may eventually seek a DOL opinion letter on the CSR issue.

Webinar: PIA conducted a webinar in June on the revised overtime exempt regulation. See **www.printing.org/webinars.** For more information and FAQs on the new rule see **www.printing.org/overtime-exempt-rules.**

Questions? Email HRQuestions@printing.org

BUCKLE UP, PRINT INDUSTRY:
THE NEXT FEW MONTHS WILL BE A WILD RIDE

Bill Michael, eMarketing Manager, Xerox

A quick recap of recent events: Amazon opened a brick-and-mortar store (yes, you read correctly); print was proclaimed as the new "new media"; companies operating exclusively through e-commerce began turning to print catalogs to boost online sales; e-book sales dipped, and print book sales increased.

There's also the unparalleled growth the U.S. commercial printing industry is experiencing, as shipments have increased compared to the prior year.

All that excitement, and that's without even acknowledging drupa, the industry's equivalent of the Olympics. Buckle up; here are six predictions for the near future:

1. INKJET AS A CHANGE AGENT

Inkjet will continue to dominate the headlines as a leading change agent.

If you're unfamiliar with its advantages, inkjet brings a higher-volume band all the benefits of digital printing—including personalization, just-in-time manufacturing, workflow automation, high-speeds, and productivity.

Many companies have made significant investments in this space. Xerox, for example, has acquired Impika and developed new products. One example is the Rialto 900 Inkjet Press, which aims to make this technology accessible to a greater number of print providers by breaking down traditional barriers to entry such as cost of ownership and footprint.

2. CLOUD-BASED WORKFLOWS AS THE NEW STANDARD

As opposed to merely being an option, cloud-based workflows will become the norm.

With a growing strain being placed on budgets and availability of resources, print providers will turn to their trusted suppliers for cloud solutions, effectively eliminating large upfront capital costs and the need for dedicated IT support. This past year, Xerox launched new cloud-based versions for FreeFlow Core and FreeFlow Digital Publisher.

3. SOLIDIFICATION OF PRINT IN THE DIGITAL MARKETING WORLD

As the digital world becomes increasingly saturated, smart marketers are looking to print as a means to truly stand apart and cut through the clutter. However, for more digital marketers to embrace this medium, greater instances of personalization and customization will be needed. This will help foster strong and lasting connections among end-users as communications cater to their needs and interests.

4. GROWTH WITHIN PACKAGING, CATALOG, AND DIRECT MAIL MARKETS

We expect to see the greatest growth in these three markets over the coming year, as each are supported and driven by personalization, regionalization, and customization. In today's marketing landscape, these are all major must-haves.

5. EMPHASIS ON MARKETING SERVICES

To thrive in an omni-channel world, many print providers are complimenting the print services they already deliver with new marketing services and capabilities. This transition strategically aligns their business with marketing and creative professionals.

Those having the most success transforming their business model understand the value of business development tools and aren't afraid to commit time and resources to ask for help and guidance.

6. TIGHTENED RELATIONSHIPS WITH PRINT SPECIFIERS

In the digital marketing world, creative agencies play a pivotal role in the evolution of print. These firms specialize in the nuances of bringing value to the media landscape, understanding the unique benefits the printed medium brings. It is important to network closely with this group, as their clientele relies heavily on their expertise and recommendations in specifying media, such as print.

The preceding article originally appeared on the Xerox Digital Printing Hotspot blog at www.digitalprinting.blogs.xerox.com/2016/04/26/buckle-up-print-industry-balance-of-2016-will-be-a-wild-ride/.

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EMBRACING THE PARADIGM SHIFT
IN CUSTOMER EXPERIENCE

Richard Lloyd, *Vice President, Service Providers, GMC Software*

When we hear the phrase "customer experience," many service providers will associate it with how happy or unhappy a customer is with their execution of their business. That's because in the past, how you service a customer has defined the core of the relationship between you, as the service provider, and your enterprise client. In this paradigm, executing tasks well was the way to build loyalty.

However, achieving a happy customer moving forward now requires the embrace of a paradigm shift in the thinking about customer experience. That's because the customer experience that will define the ability to gain and retain enterprise clients is now not only the experience of that enterprise itself, but also the experience of the enterprise's customers—and the expectations of those third-party customers are rapidly changing.

Enterprises in every industry are facing the same reality when it comes to customers expectations. They recognize that their customers want a seamless, positive experience with every interaction on every channel and many will shift business to competitors after a bad customer experience. Companies also know that a majority of customers will pay more for a better customer experience.

For these reasons, many companies are now looking to their service provider to help them deliver the holy grail of a seamless customer experience. However, this often requires changes in infrastructure to deliver what these organizations need.

While many service providers have added capabilities for delivery channels beyond print, such as email, Web, or SMS, it is often done when a customer requests it. As a result, investments over the years in point solutions to meet the particular needs of a particular customer are often managed in separate siloed departments within the organization, with little ability to coordinate them.

Despite the fact that many service providers have made significant investments in point solutions over the years, the reality is that because of the as-needed way in which they were acquired, these solutions are not able to offer the cohesive, complete omni-channel capability customers (and their customers) are demanding. To deliver

a true, seamless omni-channel experience through their customers' communications, service providers will need to find ways to overcome existing silos in the organization, create collaborative processes, and gain new channel capabilities.

All of this highlights the need for a transformative process in the production environment. The best place to start is by developing a business plan to outline the steps that need to be taken to move to the future state you desire to reach.

Developing such a business plan will require answering a number of critical questions:

- What customer communication channels are we currently not addressing that we need to address?

- Do we have the ability to serve enterprise business units using structured data in communications to produce invoices and statements, interactive data for general business correspondence, or on-demand data in Web or customer facing systems to send relevant, personalized communications to customers in different stages of the customer life cycle?

- How can we coordinate collaboration and processes internally to deliver a unified customer experience across all of the relevant channels?

- What industries will our future customer base come from and how will we differentiate our services in those industries?

- Does our sales team have the training and tools they need to sell high value and high margin services to our customers?

Answering questions like these will help determine what you need internally to meet the challenge brought about by the customer experience paradigm shift. Change is never easy and the temptation to "do what we know" is a strong one, but to keep your customers happy, it is important to push forward, even if it is with small steps in the right direction, so you are ready when customers begin asking for more sophisticated communication capabilities.

For example: Imagine your largest customer coming to you and saying, *"Our competition is offering interactive communications to its customers delivered via mobile apps on tablets and smartphones. We want to do the same."* Without mobile communications capabilities in place that have the ability to leverage information stored in multiple databases within the enterprise and manage content and applications in real-time for quick turnaround, it will be impossible to deliver what that customer needs, leaving them to look elsewhere to find it.

To prepare for the future, it is important to identify ways today to simplify technology layers and processes and enhance collaboration within your infrastructure. Success will require an integrated approach to customer communication management that will enable you to proactively approach customers with value-added offerings that excite them—and excite the customers they serve.

About the author: Richard Lloyd is vice president, service providers, for GMC Software, a leader in customer communications management. GMC Software empowers organizations to create stronger engagements with timely and relevant communications. A Neopost Digital Company, GMC Software provides the means for business users to develop contextual, highly individualized communications across all channels that span the entire customer journey. A leader in customer communications, GMC Software supports thousands of clients and partners in banking, insurance, healthcare, and service providers around the world.

OSHA'S ELECTRONIC INJURY AND ILLNESS REPORTING AND ANTI-RETALIATION RULE

Gary Jones, *Assistant VP, EHS Affairs, Printing Industries of America;* **Kaitlin Rundle,** *EHS Associate, Printing Industries of America;*
Matthew Crownover, *EHS Associate, Printing Industries of America*

OSHA's latest change in injury and illness reporting was released in May of 2016, as an addition to the self-reporting rule that was issued in 2014. The self-reporting rule requires a record of all inpatient hospitalizations, amputations, loss of an eye, and fatalities that occur within specified periods after work-related incidents.

OSHA's new rule addresses electronic injury and illness reporting and includes provisions addressing anti-retaliation for employees who report injuries or illnesses. OSHA's new rule had been pending for several years and has sparked criticism by the regulated community. The rule will require the electronic submission of injury and illness data by 2017. It also has provisions requiring companies to educate employees on how to report injuries and prevent retaliation for reporting them. OSHA also said they will take action against companies that have incentive programs, as well as mandatory universal post-accident drug testing. OSHA feels both of these activities discourage injury reporting.

ELECTRONIC REPORTING

The current injury and illness regulations require employers that have 10 or more employees to maintain records of work injuries and illnesses at their facilities. All work-related injuries and illnesses need to be recorded on OSHA's Form 300, Log of Work-Related Injuries and Illnesses, within seven days. Each February 1, Form 300A, Summary of Work-Related Injuries and Illnesses, needs to be completed and posted in a public location in the workplace for 90 days. For every recordable work-related injury or illness, a Form 301, Injury and Illness Incident Report, must also be completed. OSHA does allow a workers' compensation form to be used in lieu of Form 301 if it requires the same information.

OSHA's new rule amends the current regulations to require electronic submission of the records employers are required to keep. The information that must be submitted is based upon the type and the number of employees in a company. Individual companies or businesses with more than one facility with 250 or more employees in each location must electronically submit information from their Forms 300, 300A, and 301 to OSHA on an annual basis. Companies in certain industries, including printing operations, with 20 to 249

employees, must electronically submit information from their Form 300A, Summary of Work-Related Injuries and Illnesses, on an annual basis. Employers also must electronically submit information from the OSHA forms upon request.

The submission of the information from OSHA's 300, 300A, and 301 Forms will be phased in over several years beginning in 2017. The requirements and deadlines are summarized in the table below.

Recordkeeping Forms for Year	Establishments w/ 250+ Employees	Establishments w/ 20-249 Employees	Deadline to Submit Forms
2016	300As	300As	July 1, 2017
2017	300 Logs, 300As & 301s	300As	July 1, 2018
2018 and thereafter	300 Logs, 300As & 301s	300As	March 2, 2019 *(March 2 each subsequent year)*

OSHA plans to post the company-specific injury and illness data it collects on its public website. OSHA does not intend to post information that would identify individual employees. OSHA hopes that researchers and the public will also be able to use the data to identify work-related hazards and particularly hazardous industries and processes.

ANTI-RETALIATION PROVISIONS

In order to ensure that employees are reporting all workplace injuries and illnesses, OSHA incorporated certain anti-retaliation provisions in the rule. Originally, OSHA intended the anti-retaliation provisions to become effective August 10, 2016. But the provisions have been delayed until November 1, 2016 in response to a lawsuit challenging the rule.

The rule contains three provisions to promote complete and accurate reporting of work-related injuries and illnesses:

1. Employers must inform employees of their right to report work-related injuries and illnesses free from retaliation.

2. An employer's procedure for reporting work-related injuries and illnesses must be reasonable and must not deter or discourage employees from reporting.

3. An employer may not retaliate against employees for reporting work-related injuries or illnesses.

WORK-RELATED INJURY AND ILLNESS REPORTING

Most companies have a policy either verbally communicated or written in their employee handbook instructing employees to report workplace injuries or illnesses immediately. The final rule now requires employers to include an explicit statement advising employees that they have a right to report any injury or illness without fear of discrimination or discharge for making such a report. OSHA has stated that this obligation may be met by posting the OSHA "Job Safety and Health—It's The Law" worker rights poster from April 2015 or later (www.osha.gov/publications/poster.html).

REASONABLE INJURY AND ILLNESS REPORTING

In the explanation of the rule, OSHA feels that policies requiring an employee to immediately report an injury or be disciplined for not reporting it may also be retaliatory. OSHA believes that immediate-reporting policies will chill employees from reporting slow-developing or chronic injuries or illnesses, such as ergonomic disorders or exposure to toxic substances. According to OSHA, to be reasonable, a policy must allow for reporting within a practical time frame after the employee realized that he or she had suffered a work-related injury, rather than just immediately following the occurrence of an injury. Reporting requirements that are too burdensome or require employees to take too many steps to report an injury or illness promptly will be deemed unreasonable and in violation of the rule.

OSHA provided an example of what they would consider to be unacceptable: An employee reported work-related neck and shoulder pain a week after symptoms first appeared and was issued a final warning for failing to report his medical condition promptly. OSHA's position is that "This policy was not reasonable because it did not allow for reporting within a reasonable time after the employee realized that he or she had suffered a work-related injury."

ANTI-RETALIATION REQUIREMENTS

A key provision in the final rule prohibits an employer from discharging or discriminating against an employee for reporting a work-related injury or illness. While not directly included in the rule's final language, OSHA has included, under the umbrella of anti-retaliation, two common workplace safety policies: incentive programs and mandatory post-incident drug testing. OSHA will consider incentive programs retaliatory if they offer benefits to employers who do not report injuries and illnesses.

Mandatory Post-Accident Drug and Alcohol Testing Requirements: OSHA has now taken the position that a blanket post-accident mandatory drug and alcohol testing policy discourages employees

from reporting work-related injuries or illnesses. OSHA views that drug testing alone constitutes an adverse employment action. OSHA provided a couple of examples by stating it "would likely not be reasonable to drug test an employee who reports a bee sting, a repetitive strain injury, or an injury caused by a lack of machine guarding or a machine or tool malfunction."

However, the rule does not prohibit drug-testing policies. OSHA instructs employers that any drug testing policy must be based on a reasonable possibility that drug use by the reporting employee was a contributing factor to the injury. OSHA states that such policies should be limited to situations where drug use has likely caused the incident and for which the drug test can accurately identify impairment caused by drug use. A test merely indicates the presence of drugs in an employee's system or recent drug use; it does not necessarily identify an impairment that resulted from the drug use.

OSHA does make clear, however, that drug or alcohol testing that is required to comply with state or federal law (for example, testing of commercial drivers under Department of Transportation regulations) will not violate the Final Rule because its motives are not retaliatory. Some state workers' compensation laws require post-accident drug testing, and others have voluntary programs that provide premium discounts for post-accident drug testing, so the impact of OSHA's interpretation remains to be seen.

Safety Incentive Programs: Since 2012, OSHA has been very vocal in its position regarding certain types of safety incentive programs that discourage accident and illness reporting. OSHA does not like programs that provide a monetary incentive such as a cash reward or entries into a drawing to employees based on low injury or illness reporting rates or achieving a certain number of days without a recordable injury.

In the explanation to the rule, OSHA states that such programs would likely be considered "retaliatory." The new rule explains that "it is a violation for an employer to take adverse action against an employee for reporting a work-related injury or illness, whether or not such adverse action was part of an incentive program." This means any programs in which employees are denied a benefit on the basis of any injury or illness report would be considered a violation of the new rule.

OSHA does allow, and encourages, programs that provide a reward based on a positive outcome for participants. Programs that provide recognition or rewards for employees who follow safety rules, participate in safety meetings, recommend safety improvements throughout a facility, or participate in injury investigations, incidents, or near misses are considered acceptable. These types of incentive programs can result in improved workplace safety without discouraging injury or illness reporting.

NEW ANTI-RETALIATION ENFORCEMENT RULE

The new rule dramatically revises the conditions in which an employer can be cited for disciplinary or discriminatory actions against workers for reporting injuries and illnesses, especially when OSHA believes that no legitimate workplace safety rule has been violated. Currently, an employee must file a complaint with OSHA within 30 days of an employer's retaliatory act in order for that employee to pursue a whistleblower claim under Section 11(c) of the OSHA Act. Under the new rule, OSHA will be able to cite an employer for alleged retaliation or discrimination up to 6 months or 180 days after the occurrence without any employee having filed a claim.

This avenue of pursing remediation to retaliation is in addition to the existing approach. Employees still have the right to file a claim within 30 days, but pursing retaliation claims through the OSHA citation and enforcement process raises several concerns. The most important issue is the training that will be provided to OSHA inspectors to recognize situations where inappropriate action may have occurred. They are not currently trained for these types of investigations. Under the current system, employee complaints are handled by investigators that have special training to fully examine a complaint. It is also not clear how a retaliation citation would be resolved. The traditional approach is to impose a fine and the company pursues a corrective action per a regulatory requirement. Resolving retaliation claims can involve penalties, payment of back wages, reinstatement, as well as other

actions. With the 180-day time limit on issuing a citation, the statute of limitations for retaliation claims could be significantly expanded.

Through the new electronic filing requirement, OSHA will receive data every year so the agency can use the information to identify and target the most hazardous worksites. Although OSHA stresses that it is not adding to or changing its recordkeeping requirements, it clearly wants that data in order to focus its enforcement efforts.

ACTION STEPS

Since injury and illness records will be submitted electronically to OSHA and eventually made public, it is important to review which injuries and illnesses need to be recorded. There can be some confusion as to which ones actually need to be recorded. OSHA requires employers to record work-related injuries or illnesses that involve a loss of consciousness, restricted work activity, a job transfer, days away from work, medical treatment beyond first aid, or hearing loss. Even though OSHA's recordable criteria have improved, questions still remain about which injuries or illnesses need to be indicated on Form 300. Each injury or illness should be reviewed prior to being included on the Form 300. For companies with more than one location, the recording and reporting obligations are for each location, not the entire company, so some companies may have to file more than one report each year.

Policies regarding injury and illness reporting need to be reviewed to ensure that they include OSHA's new requirement informing employees that they have the right to report work-related injuries and illnesses free from retaliation. Policies also need to meet the criteria of being "reasonable" and allow for the reporting of injuries or illnesses that may not be immediately obvious. A reasonable amount of time must be allowed for the employee to report after symptoms of an injury or illness develop.

Before revising a drug testing policy, make sure you review any mandatory drug testing requirements that apply, such as DOT or workers' compensation regulations. Many state workers' compensation laws do require post-accident drug testing, so check with the requirements for your state. If necessary, the policy should be amended to require testing only in situations in which the drug or alcohol use is likely to have contributed to the accident or injury and when the test can accurately identify the impairment caused by the drug or alcohol use.

Safety incentive programs should be reviewed to ensure that they do not discourage employees from reporting injuries and illnesses. If an incentive program is based on a monetary award for the lack of recordable injuries or illnesses, they need to be restructured to reward participation in various activities or for following safety rules.

SUMMARY AND CONCLUSION

There are two important deadlines to keep in mind with this new rule—November 1, 2016 and July 1, 2017. Even though a lawsuit challenging the merits of the new rule has been filed and OSHA subsequently delayed the implementation of parts of the rule, there is no guarantee that the rule will be overturned.

With the new increased penalties taking effect August 1, 2016 and the first part of this new rule about three months away, printers should immediately review their workplace policies and procedures and make the appropriate modifications. If changes are made, it would be prudent to communicate the changes with employees and document that the revised policies have been provided to employees.

For printing operations with more than 20 employees, all recorded injuries for 2016 should be reviewed to ensure that they actually need to be identified on Form 300. Any that are not required should be removed as the information from 2016 will have to be provided to OSHA by July 1, 2017. Employers should be aware that OSHA may find policies to be retaliatory if they require an employee to report an injury or illness immediately. The employer must allow a reasonable amount of time for the employee to report after the employer learns of the injury or illness. Employers should also review their workplace policies and remind management about best practices for handling an OSHA inspection.

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CERTIFICATION:
PLANET VS. PROFIT?

George Glisan, *Distinguished Professor & Coordinator,*
Reese Graphic Arts & Imaging Technology Program, Appalachian State University

INTRODUCTION

I recall a number of years ago attending the keynote session of a conference, and one of the speakers made a statement that I've never forgotten. He said that at his company, "The customer is king, but cash is a real close second." While cash certainly is not the same thing as profit, a tenet of sound business judgment is the requirement that decisions to spend the company's precious cash must generate a return on investment (ROI), i.e., a profit.

According to PIA calculations there are nearly 30,000 print facilities in the United States. As of this publication fewer than 60 companies have plant operations that are certified by the Sustainable Green Printing Partnership (SGGP is the only organization in North America dedicated to certifying print production operations with respect to their "greenness"). So, implicitly, it is clear that printing industry owners/managers overwhelmingly have made a decision that spending their hard earned cash to certify the "greenness" of their plant operations simply is money not well spent. Or, put another way, their belief is that it is not financially worthwhile to pursue certification for being a "green" printer.

Anecdotally, the basic explanation offered by print owners/managers is that there is not a business case to justify the expenditure to become certified. Indeed, I once had an owner who stated to me that he wasn't anti-green; he simply believed that to do so would increase his costs of doing business and diminish profitability. When pressed for evidence that supported the conclusion, there wasn't any. Such a response, however, is anything but atypical. Indeed, the lack of widespread certified green print operations is testimony to the sentiment.

Given the foregoing, it called for research to answer the question: Does green certification of print production facilities increase costs and sacrifice profitability, or not? The only way to answer the question was to get answers from those who had undergone certification.

RESEARCH DESIGN

With cooperation from the Sustainable Green Printing Partnership With cooperation from Sustainable Green Printing Partnership, a research study was proposed to survey SGPP certified printers in order to gain answer to a series of questions that addressed a series of business performance metrics, environmental metrics, and a number of organizational demographics. Per the SGPP certification model, each print organization has one individual, a sustainability coordinator, who chairs and monitors organizational efforts in support of its sustainability initiative. That person was identified as the individual to whom the survey would be sent. Each respondent was provided confidentiality of responses and anonymity of their participating organization.

The survey was administered electronically and sent to all 57 coordinators at SGPP certified facilities. Of the 57 who received the survey, 31 usable responses were generated for a response rate of just over 54%. A review of the profile of the responding organizations revealed that typical of SGPP certified print organizations multiple processes were represented (offset, flexo, digital, etc.). As well, all sizes of organizations from small to mid-sized and large were representative as indicated by annual revenue.

To assure that the responses received were representative of the entire population of certified facilities, a goodness of fit chi square test was administered using one of the demographic questions from the survey. The computed probability was 1, indicating that respondent answers to this question were representative of the population which was surveyed.

Eight business metrics were included in the survey in order to assess impact of certification upon the commercial interests of the organization. These metrics included: Sales Revenue, New Client Acquisition, Labor Cost, Materials Cost, Operating Cost, Number of Worker Compensation Claims, Average Cost of Worker Compensation Claims, and Profit Margin.

Given the foregoing items, the survey was structured so that each respondent was asked to indicate if there had been change with regard to each of the criteria since becoming an SGPP certified facility. Three options were given to indicate a response: was the item "lower", "higher", or "no nifference" since certification?

FINDINGS

Although conventional wisdom has been that seeking green certification would adversely impact the profitability of a printing company, for purposes of this study the null hypothesis was that certification would have no impact on the commercial interests of the company, as indicated by the eight aforementioned criteria, i.e., "no difference."

Table 1 presents a summary of the findings of the survey with respect to business metrics. The data are reported with the proportion of respondents who chose one of the three response options: lower, no difference, or higher. The first metric, Sales Revenue, shows that nearly two-thirds of certified printers (62%) reported no difference in this metric after certification. Of those reporting a difference, slightly more indicated that revenue was higher rather than lower. Related to sales revenue is New Client Acquisition. For this metric, just over half (54%) reported no difference. However, 42% reported that they increased their number of new clients versus 4% reporting lower client acquisition. This finding suggests that certification was of significant help to printers for attracting new clients.

The next three metrics queried relate to costs: Material Cost, Labor Cost, and Operating Cost. For Material and Labor Costs, the largest category of response was "no difference." That said, the proportion of respondents indicating these two categories of cost were lower versus higher was double. Finally, with respect to Operating Cost, the largest proportion of responses (44%) was that it was lower since certification, compared to 41% reporting no difference and 14% reporting that this category of cost was higher.

The next two business metrics assessed relate to worker safety. The first, Number of Worker Compensation Claims, was reported by 79% of respondents as "no difference" since certification. Twenty-one percent (21%) of respondents reported that claims were lower, and none reported that they were higher. In addition to the number of claims, the Average Cost of Worker Compensation Claims was assessed. These results were very similar to the aforementioned responses.

The final business metric assessed was that of Profit Margin. Half of all respondents reported that there was no difference in profit margin

since certification. However, the number who reported they were higher (35%) was more than double the number that reported they were lower (15%).

CONCLUSIONS

The data from those printing establishments that pursued certification showed that 15% of them did, in fact, face lower profit margins. This makes some sense as 14% of respondents indicated that their operating costs were higher after green certification. However, by far, more firms reported no difference in their profit margins. Even more compelling are the 35% who reported higher profit margins... more than double the proportion of those who reported lower profit margins.

So, do the findings of the study validate the widespread belief that green certification increases costs, and therefore reduces profitability? Given that 85% of firms pursuing green certification were more likely to experience either No Difference in profitability or Higher profitability prior to certification, a strong case can be made that this is unlikely. Or, put another way, based upon the data, a firm is more than five times more likely to witness either higher profitability or no impact on profitability following green certification than lower profitability.

Given the increasing regulatory pressure being placed upon many industries (e.g., automotive, coal, energy, etc.) it is likely that printing and packaging companies will see their industry facing scrutiny on its production processes to demonstrate a greater degree of "greenness." With only a relative handful of print production facilities that are certified, the industry is in an unfavorable position to counter suggestions that it is a "green" manufacturing enterprise. This begs the question for owners/managers of print and packaging production operations, what will be the impact on your profitability if regulatory bodies impose their conditions on your operations? Are you more likely to be profitable, or unprofitable, meeting the demands of regulators? The risks of saying no to green certification, at this point, may be not only at the cost of current profitability, but possibly future profitability as well.

BUSINESS METRICS PERFORMANCE AS REPORTED BY SGP CERTIFIED PRINTERS

	"Lower"	"ND"*	"Higher"
Sales Revenue	15%	62%	23%
New Client Acquisition	4%	54%	42%
Labor Cost	27%	61%	12%
Material Cost	30%	55%	15%
Operating Cost	44%	41%	14%
Number of Work Comp Claims	21%	79%	0%
Avg. Cost of Work Comp Claims	20%	76%	4%
Profit Margin	15%	50%	35%

* "ND" represents proportion of "No Difference" responses. *Table 1.*

SUSTAINABILITY AND WIDE-FORMAT

IT'S NOT JUST ABOUT SUBSTRATES

Marci Kinter, Vice President of Government & Business Information, SGIA

Conversations between wide-format printers and their customers unfortunately cannot seem to get beyond talking about substrates when discussing sustainability. There seems to be this universal belief that if a product is printed on a substrate that has a recognized certification or if it can be recycled, then the product can be claimed as "sustainable." It's time for both the printer and the customer to move this discussion forward. Yes, substrates are important, but there are other considerations to bring into the equation when considering which to use.

The only substrates with a recognizable certification are paper products. Broadly speaking, only those paper products that are sourced in a responsible manner and meet program requirements can be certified by organizations like the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC). Also, printing facilities that use certified materials and meet program requirements can also attain this product certification. To the best of my knowledge, there are no other substrate certification programs. True, manufacturers can claim certain attributes; however, these claims are governed in the United States by the Federal Trade Commission's "Green Guides to Marketing," and while these claims cannot be seen as certifications, it's important that any and all claims be validated and relevant to the product at hand.

Just as relevant to the discussion is the shipping of the product. A question to ask the customer is whether or not they track their carbon footprint. If so, then the discussion regarding reduction of greenhouse gas emissions (GHG) is not only relevant, but also important to the customer discussion. A growing number of companies are engaging their suppliers about managing GHG emissions. However, what are greenhouse gas emissions, and why should you care?

This is a question that is often asked by many facility owners. Controversy still exists regarding whether or not global warming or climate change is actually occurring. It is not our intent to debate the pros and cons of the occurrence of global warming, but to offer a bit of information to help you understand global warming, as well as how carbon footprints fit into this issue. Both of these terms are often used by both those in our industry sector as well as the retail sector—facilities state that they have reduced their carbon footprint and thus are no longer contributing to global warming. So, what does this mean, and most importantly, how does this fit into our discussion regarding substrates?

To begin, the term climate change is often used interchangeably with the term global warming, but according to the National Academy of Sciences, "the phrase 'climate change' is growing in preferred use to 'global warming' because it helps convey that there are [other] changes in addition to rising temperatures."

A carbon footprint is a measure of the impact our activities have on the environment, and in particular climate change. It relates to the amount of greenhouse gases produced in our day-to-day lives through burning fossil fuels for electricity, heating, transportation, etc. When facilities indicate that they have reduced their footprint, they are referring to steps they have taken to reduce the use of energy and fossil fuels in their facilities. This is how it relates to the substrates used by printing facilities. Your carbon footprint reflects the energy used to not only produce the product, but also ship it to its final destination.

So, now that we are all on the same page, how can a facility reduce its greenhouse gas emissions, also known as its carbon footprint? To offer effective, straightforward suggestions, we can turn to the certification criteria for the Sustainable Green Printing Partnership Program (SGP). Within the criteria, the following requirements exist.

First, the criteria require that when replacing equipment, purchase Energy Star compliant (or equivalent, based on country of manufacture) equipment such as computers, monitors, servers, refrigerators, and microwaves. Energy Star has long been recognized as a viable eco-labeling program that identifies energy efficient products that can be used in both the home and office. The Environmental Protection Agency (EPA) estimates that if all consumers purchased Energy Star products and equipment over the next 15 years, Americans' energy bills would be reduced by $100 billion. The annual pollution savings would be equivalent to taking 17 million cars off the road.

A second strategy is to conduct an energy audit. Specifically, the SGP Program requires facilities to document, through an internal or outsourced audit, options to reduce energy use including occupancy sensors, programmable thermostats, energy efficient lighting, gas and water use, insulation, or implement appropriate energy reduction projects. Conducting an energy audit, in which you perform a walk-through of your facility in order to ensure all equipment is working properly, is a great way to examine your facility for any energy wastage and inefficiencies. It is imperative that your company commits to continuous evaluations of your facility's energy usage, and assigning

ENVIRONMENTAL

an energy management team is a great way to ensure your company's commitment to assessing and improving your energy conservation. The best way to conduct an energy audit is to complete a checklist that covers different areas in your facility, which includes lighting, heating and air conditioning, equipment, and energy behavior. Reviewing your utility bills to check which zones your facility is using the most energy is a good indicator of areas on which to focus.

Reducing your energy usage not only reduces your carbon footprint, but operating costs as well. Facilities have found that by conducting an energy audit and implementing recommendations, energy usage has dropped as much as 45 percent! However, your energy usage is just one part of the carbon footprint story. Another element to consider is the shipping of the final product.

To determine the footprint of your shipping, a baseline is needed. The most efficient way to start tracking is to join the U.S. Environmental Protection Agency's SmartWay program. SmartWay is an innovative, voluntary, public-private, market-driven partnership. SmartWay helps companies improve their transportation supply chains to move more ton-miles of freight with lower emissions and less energy and at a lower cost. The best part is that it is free to join and use their tools. In 2015, the Specialty Graphic Imaging Association (SGIA) became an Affiliate Partner of the program in both the U.S. and Canada, supporting the efforts of printing facilities to start tracking and reducing the emissions associated with their shipping. Print facilities participating in this program have validated information regarding the shipping of their products providing one more discussion point with your customer.

The overarching conclusion is that even if your customer only asks about alternative substrates, there are ways that you, the print facility, can take advantage and turn the discussion into a deeper dive on sustainability issues. Take a few moments to discuss with your customers their sustainability goals and objectives. You might just be surprised at where it takes you!

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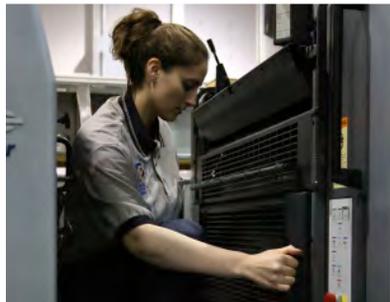
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An independent panel of notable decision makers named these technologies deserving of a 2016 InterTech Technology Award. The innovations listed here are expected to significantly advance the production of the graphic communications industry in the near future.

★ **Omnifire 250**
Heidelberg

★ **Heidelberg Stahlfolder TH 82-P: Streamfeeding in all Stations**
Heidelberg

★ **Highcon Beam with 3D Modeling**
Highcon Systems Ltd.

★ **Imp**
InSoft Automation

★ **Xerox® Color 800i/1000i Press Metallic Dry Inks**
Xerox Corporation

★ **Xerox® Versant® 2100 Press with Ultra HD Resolution**
Xerox Corporation

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This year we are pleased to present the **2016 Printing Industries of America InterTech™ Technology Awards** recipients. Fourteen technological innovations were presented for consideration and six were selected to receive honors by our independent panel of judges. This premier program recognizes emerging technologies that have a significant impact on the advancement of the graphic communications industry.

The InterTech competition is conducted annually by Printing Industries of America to showcase and encourage continuous development of new products and technologies that aim to improve the industry, increase production quality, and foster operational excellence.

Each entry is judged against specific criteria. First and foremost, the technology must be truly innovative—not just an evolutionary improvement to an existing product. Further, it needs to enable printers to operate more efficiently or provide new products or service adopters with a clear return on investment. Finally, the product or service must be commercially available, yet not be in widespread use.

"The judges review each technology entry and then gather to vigorously debate their 'breakthrough' nature," said Jim Workman, vice president, Center for Technology and Research for Printing Industries of America. "We assume all of the technologies are excellent performers, but which ones are truly innovative? That's the question the judges grapple with."

The InterTech star, recognized as a symbol of technological innovation and excellence, is presented to the recipient companies before an audience of industry leaders during the Premier Print Awards Gala, Sunday, September 25, 2016 held in conjunction with GRAPH EXPO 16 in Orlando, Florida.

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Omnifire 250

Heidelberg • Kennesaw, GA • www.heidelberg.com/us

With the Omnifire 250, Heidelberg combines UV inkjet printing with advanced robotics to facilitate the personalization and decoration of a wide variety of three-dimensional objects. Different from most other solutions in this market, which are designed for industrial printing on a static shape or size, the Omnifire 250 offers flexibility, speed, and easy changing between objects of varying size and silhouette.

The Omnifire 250 provides immediacy to personalization of objects having complex shapes and a wide variety of surface characteristics on a mass production device. It transforms the type of objects that can be personalized using non-contact printing thus opening up existing and new markets/ customers. The printer design and ease of use means the Omnifire 250 can be used in a retail or industrial environment or even as a mobile print center at sporting and music events.

Digital printing using the Omnifire 250 enables product decoration and personalization to be delayed to the last point in the production or sales cycle, providing significant added value to the product. It democratizes the printing to companies of all sizes and the potential applications are boundless, limited by the imagination of the user.

The Omnifire 250 is capable of printing on spherical, cylindrical, and conical objects up to 11.8 inches (300 mm) in size. It can print up to five colors, as well as pretreating the object with either plasma to change the surface energy or with a primer. The UV ink is initially cured after each color is printed and then a final UV curing is applied. This provides abrasion resistance and adherence characteristics of the image, with the object being able to be used immediately once removed from the machine. Coating applications are also available when needed for aesthetic or further protection requirements.

The Omnifire 250's inkjet heads have the ability to print up to 70mm wide for 360 degrees around the objects to be printed. If a wider image is required, then stitching of the image for multiple passes adjacent to each other is carried out. This required the development of additional control algorithms so that the quality of the image was not degraded as part of the stitching process. Prior to printing, the object's shape and size are verified for dimensional tolerance by the machine to ensure safe operation of the

HEIDELBERG

▶ The Heidelberg Omnifire 250

▶ The Omnifire 250 is capable of printing on spherical, cylindrical, and conical objects.

▶ **JUDGES' ANALYSIS**

The Omnifire 250 personalizes and decorates a wide variety of three-dimensional objects using automated UV inkjet printing. Unlike traditional solutions, it can quickly print one item like a soccer ball and then switch in seconds to a different item such as a wine bottle. The InterTech judges singled out the Omnifire 250 as a breakthrough technology that will lead to new applications and business opportunities.

machine, reliability, and print quality. Following the scan, the deviation from the defined shape is calculated and the advanced robotics then adjust the relative position of the object, on the fly, as it moves under each of the print heads ensuring maximum print quality and maintaining the integrity of the heads from contact with the object.

High precision robotics are used by the Omnifire 250 for axial and rotational control of the items being printed. The objects are all scanned prior to printing so that any variations can be adjusted for and the optimal

distance from the print head maintained. Control algorithms allow for precise register and smoothness of print quality throughout the full print swath.

This is further enhanced with non-spherical objects by adjusting the printing speed, ensuring that the highest print quality is achieved regardless of image size or shape. In addition, the design utilizes quick-change object holders that minimize makeready time with changeover between objects being only seconds.

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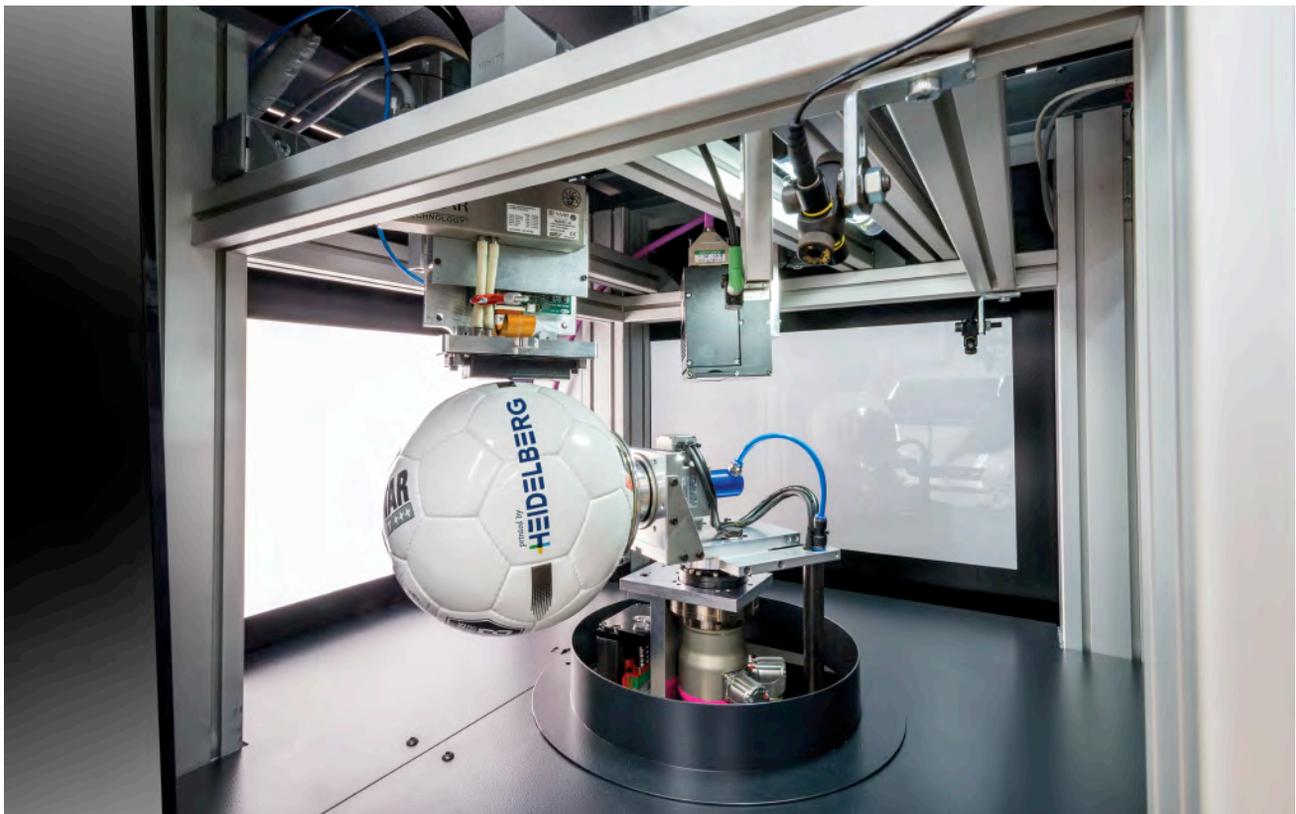
▶ The Omnifire 250 uses high-precision robotics for axial and rotational control of the items being printed.

Stahlfolder TH 82-P: Streamfeeding in all Stations

Heidelberg • Kennesaw, GA • www.heidelberg.com/us

Heidelberg's Stahlfolder folding machines were designed with an emphasis on their ability to fold various jobs economically with very short throughput times with consideration of production quality and cost effectiveness. The new TH 82-P model builds on that premise by offering:

- Speeds beyond 15,000 sheets per hour with a 50 percent increase in throughput for 16-page signatures, compared to industry leading single sheet buckle plate folding

- The same fold quality and versatility of substrates as with current processes as the linear speed remains constant in the comfort zone of conventional folders (below 170 m/min)

- Full versatility of a conventional buckle plate folder, as conventional folding schemes are being used, standard plates can be used in all units and the machine is portrait-fed

- True one-person operation with advanced pallet feeder and delivery

- Improved efficiencies in the bindery by matching one press with just one folder with annual productivity potential of more than 40 million sheets

Overall folding technology, in regards to increasing net output per hour to equal the pace of today's presses, has come to a crossroads.

The challenge is that with a linear speed increase it becomes more difficult to control the quality and consistency of the folds. The TH 82-P solves that problem. Heidelberg engineers addressed the linear speed of folding paper with streamfeeding, taking into consideration the paper grain and paper weights to significantly improve the net performance and quality.

The streamfeeding innovation takes place in all of the stations from the feeder onto the infeed registration table as well as the cross carriers on the second and third stations. Until this point, streamfeeding was only used in the infeed; applying it throughout the folder was considered too difficult to engineer. Yet exactly that enables the TH 82-P to manufacture 16-page signatures up to 15,000 an hour while the linear speeds remains in the comfort level of 150-180 meters a minute compared to the 10,000 that is being produced today with the same linear speed.

The engineering technology, developed by Heidelberg for the folder, enables today's customer to run 16-page formats at 15,000 an hour. This folding concept matches closely to today's presses. One long perfecting press equals one folder! Streamfeeding every station (the cross and the two parallel stations) is the hallmark innovation of the "P"-Generation folders: a shingle (i.e. an overlap) of up to half the sheet length enables a 50 percent higher throughput at the same linear speed; three sheets can now pass through each fold station at the same speed and time that it took before to process two sheets when producing 16-page signatures.

▶ The Heidelberg Stahlfolder TH82-P

Folder Linear Speed & Productivity
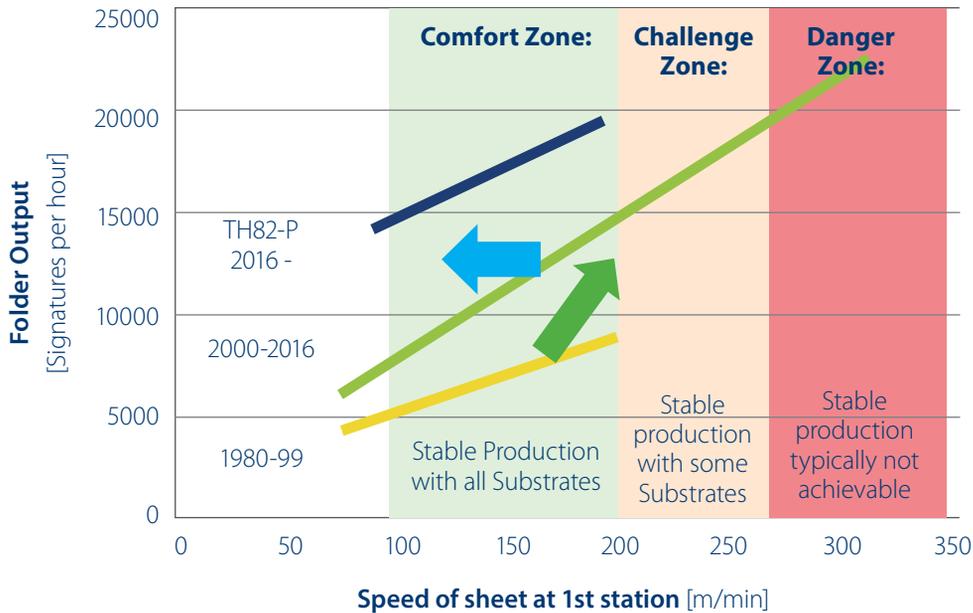
New streamfeeding technology enables exellent quality
due to lower linear speed and higher throughput

Air management separates the sheets or folded signatures in the fold plates. While one sheet is exiting the plate, the next one is already arriving. New pressing rollers integrated into the fold units create a sharper fold, thereby stabilizing the fold process even further. At the cross carriers for the second and third stations, each sheet is individually accelerated. Additional design changes allow the stream of folded sheets at the second and third station.

The TH 82-P allows the operator to keep the linear speeds in the conventional comfort zone (below 170 m/min) yet output is increased by simply turning to streamfeeding in all stations. Even lighter substrates will experience this productivity increase, all the while maintaining the same fold quality achieved before in the less efficient single-sheet operation.

Lean manufacturing principles are more important for printers today than before to minimize waste and drive as much high quality finished product as possible, realizing lower costs and higher profits. With offset presses running regularly 18,000 sheets per hour, bottlenecks in folding are prevalent. This drove the need for higher efficiency folding. The efficiencies of the new platform TH 82-P stream feeding innovations have numerous benefits. The finishing department has an increased net output by more than 50 percent. One Stahlfolder TH 82-"P"erformance with automation can replace two to three legacy inefficient folders with

one and reduce labor overhead and the space needed for intermediate storage. In summary, the manufacturing process is shortened and a positive gain in the finishing process is realized.

In the overall analysis from the recently installed TH 82-P, the customers have seen an increase in net productivity of at least 50-67 percent on 16-page signature work. Customers with the TH 82-P are now running 15,000 sheets per hour with one operator, while their price per performance ratio on legacy equipment was around 5,000-9,000 an hour with one to two operators.

▶ JUDGES' ANALYSIS

The judges were won over by the engineering ingenuity and productivity gain of the Stahlfolder TH 82-P. The hallmark innovation is streamfeeding, a mode that enables a 50% higher throughput at the same linear speed. This approach means that the folder can produce at the speed of a sheetfed offset press, while maintaining the same fold quality achieved in single sheet operation.

INTERTECHAWARDS

Highcon Beam with 3D Modeling

Highcon Systems Ltd. • Yavne, Israel • www.highcon.net

▶ The Highcon Beam digital cutting and creasing solution extends the digital finishing revolution to mainstream production.

The Highcon 3D Modeling capabilities in conjunction with the Highcon Beam digital cutting and creasing machine introduce 3D production and manufacturing to converters, printers, and trade finishers wanting to extend their business. The Rapid Layer Manufacturing technology takes any standard STL file and automatically slices the model into layers to be cut, according to the thickness of the substrate used.

Instead of working for weeks or using other 3D technologies with material cost that can reach tens of thousands of dollars, Highcon's machine builds large scale masters, molds and patterns for a fraction of the cost compared to any other 3D vendor, and most importantly in minutes rather than days.

Highcon technology can use easily available and paper-based substrates with a low price tag. They can even use printed paper that is the waste by-product of other processes in their business. An offset printing press, for example, can require a large number of sheets (100-500) as "press make-ready" for each new print job. Under specific conditions, the waste output of the press can be reused as the basis for 3D models with a positive effect not only on the business but also on the environment. Thinner paper allows for more accuracy and finer details but slows down the process. Thicker paper dramatically shortens the production time. However, unlike in printing, the surface of the substrate is irrelevant

as the sheets are stacked to create the model. The grade of paper and top coating layers, which usually impact the substrate price, are not a consideration.

The real innovation in the application of this technology is the combination of the precise digital cutting of the Highcon Beam, which has three 1,000 watt lasers that can cut up to a top speed of 5,000 B1/42-in. sheets an hour, with the Variable Data Cutting module, sold together with the Beam, and the 3D Modeling option. Variable-data printing has been around for a long time, but variable-data cutting is relatively new and turns a technical process into an opportunity for differentiation. Variable-data cutting can transform simple products into premium ones

▶ JUDGES' ANALYSIS

The combination of Highcon Beam's digital cutting and creasing capability and the optional 3D Modeling module lets users build large scale masters and molds for a fraction of the time and cost of other 3D technologies. This is an intriguing application that lets printing companies get involved in 3D applications with a material—paper—that they're already familiar with.

by adding customization and personalization. Variable-data can be used to cut not internal cutouts but rather layers. With the addition of the 3D Modeling module, which translates a standard STL file into layers, the result is digital data sent to the Highcon Beam in the form of hundreds or thousands of individual files.

The Highcon Beam can process all these files to produce large models or molds within minutes, which would take hours, if not days, using current 3D printing applications using polymers. The end result is the ability to perform 3D production, rather than 3D prototyping, at far higher speed and much less cost.

In comparison to existing 3D printing technologies like FDM, PJ, SLA or SLS, the Highcon Rapid Layer Manufacturing technology that is behind the 3D Modeling option is 15 to 50 times faster and material costs can be up to a 100 times cheaper. Also existing 3D printing technologies hardly ever reach the size of models or molds that can be produced easily and quickly on the Highcon Beam, so this opens up a whole new world of applications.

The range of applications for Highcon's 3D modeling capabilities is wide with uses for point of purchase, stands, display, furniture, tooling for composites materials, masters for concrete and plasters castings and patterns for vacuum forming. Complex 3D models can be used to highlight products and appeal to consumers for promotional purposes as a supplement to other brand activities including packaging for high-end and premium products.

Once a 3D model has been produced and removed, the remaining waste paper (the negative of the product) can be used as a mold or as a master

mold for larger volume production. In this way, the process utilizes 100 percent of the raw material, and designers can also create a single prototype of the product from the final material (like concrete) before producing the final mold.

There are several applications of model production that require a mold. Two specific examples are carbon fiber products or decorative architectural concrete elements.

With Highcon 3D Modeling, a paper mold can be produced quickly, with dramatic reduction in time and cost. Complex structures and textures can be created that are impossible in any conventional molding technology or in any known additive manufacturing technology. Fine details and smooth surfaces are achieved, when required, by very little post-processing. The bench in this image is around two meters long and could simply not have been produced by any other current 3D printing technology.
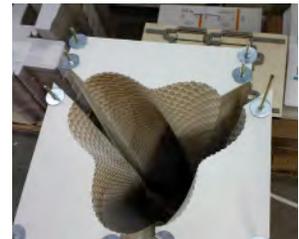
▶ Creating molds from waste paper allows for 100 percent utilization of raw materials.

▶ Highcon 3D Modeling makes possible the production of pieces with fine details and smooth surfaces.

IMP

InSoft Automation • Chennai, India • www.insoftautomation.com

Imp's smart print layout creation technology is a versatile, stand-alone, and affordable application that supports offset, digital, and wide-format inkjet presses. It impacts material efficiency and machine productivity by helping printing companies accelerate and optimize layout planning on rectangular-cut, die-cut, and combination jobs, both sheetfed and rollfed. It can be easily integrated into most workflows.

There are many traditional imposition software products that now offer ganging engines for flat rectangular jobs and fewer solutions that provide layout planning for non-rectangular jobs. While some solutions target offset printing only, others target wide-format only. Imp's versatility makes it a solution for many types of printers, such as commercial printers that produce both commercial and packaging jobs.

With such an automated print layout planning software, another major benefit is the quick and accurate estimation and quote generation. With all the intelligence built into the software an estimator can, without much knowledge of production, generate accurate layouts and use them in his estimates.

Imp software has been certified by CIP4 for JDF compatibility. The software integrates seamlessly with almost all popular prepress workflow solutions. JDF output for guillotine cutting and folding have also been proven in the field. Apart from the out-of-the-box standalone module, a software development kit (SDK) is also available for MIS / ERP solutions providers to integrate Imp software. A half dozen MIS/ERP software providers use Imp's planning engine to ensure accurate estimates and provide a seamless production workflow.

The software was designed based on the following philosophy:

Built-in Intelligence: Automatically create cost-based layouts that ensure that all operations, including finishing, can be carried out correctly.

Optimization: Optimize paper utilization after considering all process costs accrued while printing, guillotine cutting, die making, die cutting, and binding.

Workflow: Reduce complexity by having a single interface for book imposition, flat jobs, and nested layouts for die-cut jobs. Die Making is one process that makes the workflow for die-cut jobs very different.

Operators spend considerable time ensuring that any opportunity to reduce the die rule length is not missed. Imp automates this process by creating single cuts where possible. When the same layout is being prepared for print, a prepress operator spends considerable time resolving bleed overlaps. A complex geometric problem (finding medial axis) was solved for automating this task.

Imp's planning engine for bound jobs calculates the assembly plans and the layout plan in a single step. Understanding commercial book printing and capturing key parameters that play a part in decision making was the challenge.

When ganging multiples jobs with varied quantity and size, the software computes many permutations and combinations, generating thousands of layout options in the process. Some layouts might be very efficient in
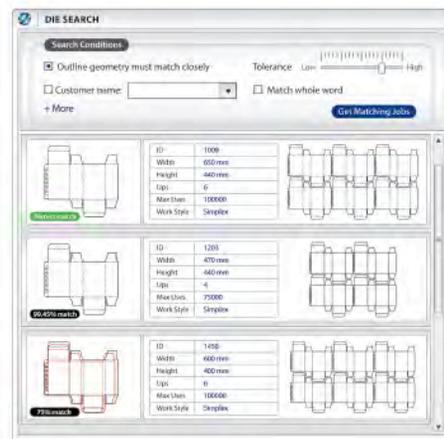
0% CHANCE OF MISSING A REUSABLE DIE!

▶ Imp has developed an advanced die-searching algorithm.

terms of wastage but costly to cut. The challenge is to quickly evaluate the number of cuts required for each of those layout options. As a result of built-in intelligence, Imp can quickly compute the minimum guillotine cuts required for any layout.

When it comes to signature layout, the software computes the maximum folding depth (layers of paper) for every folding template. It also assesses the assembly of folded signatures for good binding results. Imp takes paper caliper, press size, and binding and folding machine constraints into account.

Sourcing print sheets from roll stocks means that one of the dimensions can be optimized. Imp's ability to suggest roll sizes from the paper/board roll stocks in the inventory results in paper savings. While doing so, the software is also aware of the additional cost of cutting rolls from a roll stock before sending it to a sheet-fed press. The user is assured that the software will find the best sheet fit for the job.

When constrained by an available list of sheet sizes or roll stock widths, it is critical to consider multiple interlocking patterns for a single job. Imp can dynamically generate the repeat pattern that is best for that sheet size.

Another complexity in the case of die-cut jobs is finding an existing die to be reused. Typically, if a printer searches for an existing die at all, it requires an operator searching to write smart queries to a database system using metadata and dimensions of the carton. The judges were particularly impressed that Imp has developed an advanced die-searching algorithm that can search thousands of dies and find any die whose outline geometry is a match, within a given tolerance, with the job(s) on the layout. It is no longer necessary to use metadata like customer name, carton style, etc. to find a matching die, and it shows a graphical preview of how close the dies match.

SELECTING THE RIGHT SIGNATURES & ASSEMBLING THEM

Import job definition from an XML or feed manually.
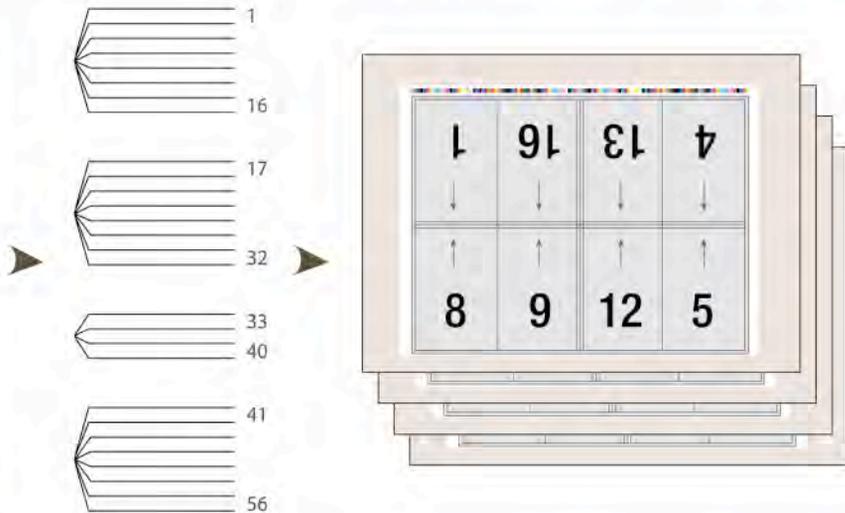
Imp automatically selects the signatures, press sheet size, work style and press. Partial signatures are handled automatically. Graphical UI allows the user to modify the section plan with ease.

▶ JUDGES' ANALYSIS

Imp software is a versatile and stand-alone tool for planning and creating print-ready layouts. The standout feature is the ability to automatically optimize layouts across a variety of job types and print processes. The InterTech judges were impressed with Imp's innovative features, its flexibility, and its accessibility to printers of all sizes.

THE BEST IS NOW THE AWARD WINNING BEST.

Imp
Complexity Simplified!
Rapid Print Layout Creation

2016
INTERTECH™
TECHNOLOGY
AWARDS

PRINTING INDUSTRIES OF AMERICA

FOR INNOVATIVE EXCELLENCE
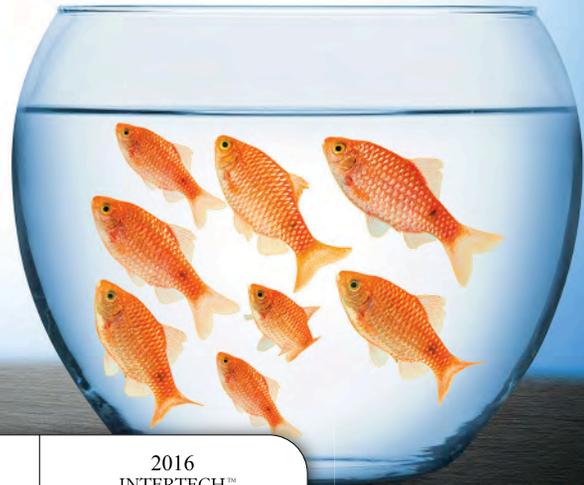
Imp wins the 2016 Intertech™ Technology Award, We take a bow!

Imp is *the* intelligent layout optimization software capable of addressing Digital, Offset and Large Format Printing needs and the only print automation tool designed for today's versatile print operations.

Imp…..because technology drives business drives technology……and there is nothing quite like it, out there.

InSoft
AUTOMATION
Automate & Optimize!

Visit us at **www.insoftautomation.com** and discover how print businesses all over the world are profiting from our technology.

IN CELEBRATION OF PRINTING INNOVATIONS
THAT MAKE THE WORLD WORK BETTER.

Congratulations to all of the 2016 InterTech™ Technology Award Winners.

We are proud to receive two 2016 InterTech Technology Awards for innovative excellence in graphic communications for the Xerox® Color 800i/1000i Press Metallic Dry Inks and the Xerox® Versant® 2100 Press with Ultra HD Resolution. **Work can work better.**

Xerox® Color 800i/1000i Press Metallic Dry Inks

Xerox Corporation • Webster, NY • www.xerox.com

The Magazine

36

PRINTING
INDUSTRIES
OF**AMERICA**

09.2016

Xerox® Metallic Dry Inks provide an alternative to traditional foil stamping and offset metallic inks with a cost-effective, short-run, inline digital alternative. What has been conventionally achievable using offset printing can now be delivered through a single digital production press running up to 100 pages per minute. Eliminated are the time investment, custom dies, materials, waste, and workflow steps that are cost prohibitive for short runs and variable-data jobs. Xerox® designed Metallic Dry Inks with the concept of streamlined digital workflows, fast turnaround time, and impressive metallic effects in a wide variety of static and variable applications.

Xerox had to make sure the image quality performance of the Metallic Dry Inks met expectations. If the flop index (a measure of the light reflectance or shine) of the metallic dry inks is not high enough, the resulting application's value will not meet the customer requirements and will not reach the acceptable level for bringing production in-house.

At the same time, the metallic dry ink performance cannot negatively impact the CMYK image quality performance. Ideally, the desired metallic image is attained in one pass as on the Color 1000i Press.

The system is capable of being successfully supported with standard operator skill sets and does not require "press master" expertise, a key to widespread adoption of the technology. Adding metallic dry ink into a CMYK printing process has traditionally required a significant negative productivity impact. The Color 800i/1000i Press is capable of running metallic dry ink at rated print speed for the media size and weight being run. Also critical to success is the fact that the capital and operational costs are kept fairly low, so that the premium value from using the metallic inks results in solid profits and new business opportunities.

Printing companies and enterprise print operations can expand their businesses by applying silver or gold dry inks to company logos, brand collaterals, graphic images and photos, headlines, names, or virtually any

▶ The Xerox Color 800i/1000i Press.

visual or text element. Popular applications include menus, invitations, key fobs, stickers, folders, business cards, lottery tickets, art posters, award/recognition certificates, letterhead/insignias, window clings, newsletters, direct marketing campaign pieces, greeting cards, photo books, and photo gifting.

In recent years, metallic printing that can reflect light has been growing in popularity for its versatility and ability to create a dramatic impression. It is used for various application purposes in the printing industry such as greeting cards, book covers, labels, and packages. Xerox venture partner, Fuji Xerox, made it possible to use a reflective pigment by adapting the emulsion aggregation (EA) method used to produce Color Press toner, thereby succeeding in developing silver and gold toner that is capable of the energy-efficient, low-temperature fusing achievable with EA-Eco toner while maintaining a high sheen.

With the conventional pulverization method, it was only possible to produce unevenly shaped toner particles whose reflective pigment particles were not oriented consistently. Also, the conventional toner particles had pigment particles that were not completely contained within the toner particles and protruded outside, resulting in image defects due to insufficient charging and transfer defects from electricity leakage caused by the protruding pigment. Therefore, it was difficult for this toner to be

used with the xerographic system. To address this, Fuji Xerox utilized and adapted the EA method to orient the flat reflective pigment particles in the same direction, thereby developing ellipsoid-shaped toner particles that can fully contain the pigment particles. This new method allows the toner to meet both the basic performance requirements for toner as well as the performance requirements for metallic printing. In this way, this toner can be used with the Color 800i/1000i Press's xerographic system.

By making the shape of each toner particle into a flatter ellipsoid shape, it is possible to align the orientation of the reflective pigment particles that are contained within the toner particle with the long direction of the toner particles. Hence, when toner is transferred onto media (paper or film), its pigment particles lay parallel to the media, allowing for higher reflection of light from the pigment after the image is fused onto the media to achieve gloss index and create a metallic appearance.

This reflective pigment does not allow light to pass through it, and therefore the color of the underlying media does not show through in areas where this toner is printed. This means that images with a highly metallic appearance can be printed not only onto plain white paper but also onto various other kinds of media, such as media that already has printed text, dark substrates, textured stocks, synthetic materials, and transparent film.

► The Xerox Color 800i/1000i Press and Xerox Metallic Dry Inks enable fast turnaround times and impressive metallic effects in a wide variety of static and variable applications.

► **JUDGES' ANALYSIS**

Using a fifth housing station on its Color 800i/1000iPress, Xerox figured out a way to not only engineer reflective pigments, but to apply them to achieve a high sheen gold and silver. The metallic pigments open the door to migrating lucrative foil stamping or metallic ink offset applications to personalized and print-on-demand jobs.

Xerox® Versant® 2100 Press with Ultra HD Resolution

Xerox Corporation • Webster, NY • www.xerox.com

Ultra HD Resolution is new technology that is designed to generate and maintain the highest possible image quality throughout the entire imaging chain, from the print server, through data transfer to the print engine and the xerographic components of press itself. Ultra HD Resolution is a precise combination of increased RIP resolution, a proprietary imaging path through the system, and VCSEL ROS technology (the laser used in the xerographic printing process).

As a complementary set of core technologies, Ultra HD includes features that optimize RIP resolution, color depth, halftoning, and print imaging density. Together, these technologies produce dramatic new levels of image quality for vector images, fine lines, text, and ultra smooth gradients without visible stepping. The Versant 2100 print servers now have the capacity to RIP at a resolution of 1,200 x 1,200 dots per inch (dpi). This is quadruple the resolution of previous-generation presses, and it results in extremely fine lines and sharp text.

Both EFI printer servers available for the Versant 2100 feature the ability to resolve color to a depth of ten bits per color. This means that the print server can resolve up to 1,024 levels of color for each CMYK separation. This is a far greater resolution than in previous generation presses, which used a color depth of only eight bits. The result is extremely accurate color reproduction, and an unprecedented ability to produce smooth, accurate gradients. EFI has branded this technology "Fiery Ultra Smooth

Gradients" because of its ability to reduce stepping or banding in a gradient blend and deliver superb image-smoothing.

Color reproduction on a digital press is a complex matter, but there are some key facts that are useful to know when working with customers. The primary job of the print server is to "RIP" the input file. RIP is an acronym for Raster Image Processor. Raster image processing is the process of turning vector digital information, such as a PostScript file, into a high-resolution raster image, or bitmap. On any digital press, the resulting RIP has two important components: resolution (the number of dots per inch) and color depth (the digital representation of the color of each dot). Both the resolution and the color depth on the Versant 2100 is the best in the industry.

With the EFI print server, the RIP resolution is 1,200 x 1,200 x 10. This means that there are 1,200 dots per inch horizontally by 1,200 dots per inch vertically by ten bits per dot. The ten bits per dot is called "color depth" because it defines the exact shade of each dot in the resolution matrix. If you multiply out 1,200 x 1,200 x 10, it means that each square

▶ The Xerox Versant 2100 Press with Ultra HD Resolution.

inch on a printed piece is represented by 14,000,000 digital bits of information. This is extremely high resolution and extremely high color depth.

The Versant 2100 uses four primary colors: cyan, magenta, yellow, and black (C, M, Y, and K). Ten bits of color depth means that the halftoning algorithms on the press can print each of these primary colors at the visual equivalent of any one of 1,024 shades, or levels of saturation. Eight bits of color depth would reduce that number to 256 shades ($2^8=256$).

When printed at very small physical size and in close proximity, these four primary colors work together to fool the eye into seeing the entire color spectrum on the printed page. The color teal, for example, is produced with a halftone dot that is approximately 80% cyan, 10% magenta, 45% yellow, and 0% black. Orange is approximately 0% cyan, 50% magenta, 100% yellow, and 0% black. Various shades and tints of these colors are produced by varying the percentages of the primary colors.

> **▶ JUDGES' ANALYSIS**
>
> Ultra HD Resolution lets companies print more color levels and produce jobs at 1200 x 1200 dots per inch on the Xerox Versant 2100 press, a quadruple increase in resolution from previous generation presses. The judges were amazed by the print quality, noting that with the resolution increase there's no longer a reason to avoid the elements that used to be a problem for digital print—gradients, thin fonts, and vector graphics.

More than 1,000 possibilities for each primary color provides extremely accurate, lifelike color renditions on the Versant 2100. In graphic communications, beautiful, smooth gradients are now possible that simply could not be printed at eight bits of color depth without noticeable banding.

The following graphic illustrates how the extra color depth delivers thousands of addessable shades in a vector gradient to smooth out transitions.

1 bit, or $2^1 = 2$ shades

0	1

2 bits, or $2^2 = 4$ shades

00	01	10	11

3 bits, or $2^3 = 8$ shades

000	001	010	011	100	101	110	111

4 bits, or $2^4 = 16$ shades

0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111

10 bits, or $2^{10} = 1024$ shades *(individual tables cells were eliminated for simplicity)*

0000000000 - 1111111111

Traying on Press System (TOPS) with Ultra HD Resolution

Buck Automation • Burlington, MA • www.buckautomation.com

Addressed mail needs to be sorted, trayed, and palletized to USPS-DMM standards. Addressing direct-mail pieces on press is not the solution hoped for since, once addressed, traying requires slowing the press down or 10 to 30 man-hours of offline traying for every hour of printing. TOPS™ overcomes this challenge. TOPS automatically trays addressed direct-mail inline with your web press. Press speeds can be more than 500,000 pieces per hour or 200 pieces per second. A new mail tray can fill as fast as once every second.

As mail trays come off your press, the prepared mail is palletized and taken directly to the shipping area. This substantially reduces the time to get direct-mail jobs into the mail stream. TOPS combines two very different departments at the end of the press. First the usual and necessary web operator's needs are addressed. Press waste and print samples are handled automatically by procedure and equipment. Next, the necessary mailroom procedures for processing direct mail to the USPS standards are accommodated inline with your press.

BuckAutomation.com

The postal zip-code tray breaks are always correct with TOPS since no printed marks are required on the printed/addressed mail piece and therefore there are no mark-sensors to adjust or fail. Integrity sensors monitor and control the process flow of material. Your customer's mail is untouched by human hands.

Direct mail has many variations and rate classes that must be automatically taken into account. This requires automating all the details. The "System" part of TOPS ties together all the press components to minimize, track, and dispose of waste to the individual addressed mail piece level.

TOPS delivers the three things your direct-mail print buyers desire:

1) Reduced cycle time
2) 100% integrity
3) 100% accuracy

PRISMAsync Advanced Color Management Profiling and Calibration Engine

Canon USA • Melville, NY • www.canon.com/usa

Calibration is the foundation upon which digital print is built. It's the starting point for all operations, daily print, output profiling, proofing, and job reprints. Historically, digital printer calibration varied by manufacturer. G7® calibration with its roots in lithography wasn't originally designed for digital printing and no digital front end (DFE) was able to use a G7 curve as the base calibration. The only way to achieve a G7 state was to apply the G7 correction to a profiling target; this method was complicated and time-intensive.

Drawing on the idea that digital press calibration should be a simple procedure that every operator can execute, Canon is the first digital press provider to implement G7 calibration directly at the DFE and PRISMAsync Color Print Server is the first DFE-embedded Idealliance G7 Certified System.

G7 calibration has for years been the de facto standard in offset printing. Canon, with its own developed calibration engine, has embraced this standard for calibration of the PRISMAsync family of color print servers. Instead of the traditional, complicated method, Canon created a unique,

simple, wizard-driven procedure and software embedded in the PRISMAsync color print server to remove virtually all of the challenges to G7 calibration for a digital device.

Canon
SEE IMPOSSIBLE

To further empower customers to higher levels of quality, Canon has included a profiling engine to create output profiles, either to achieve G7 targeted or color space conformance, or simply to create an output profile in order to improve gamut and consistency for in-house goals. These DFE-based tools require no additional training for the average end user to achieve high standards of quality and consistency. No additional investment in software, hardware, or training is required. This increased user convenience is expected to vastly increase the accessibility of G7 calibration for printers using digital presses and decrease barriers to profile creation for all users.

MegaEdit

Infigo Software • Crawley, West Sussex, UK • www.infigosoftware.com

MegaEdit is the flagship solution of the Infigo Software range, which delivers flexibility and functionality within the web-to-print marketplace. Designed by print professionals applying technical knowledge and experience, this online design tool offers an extensive range of editing capabilities which can be used for photo book creation to complex multipage documents. This allows businesses to expand their online offerings while increasing profitability. The HTML5 editor is fully responsive, meaning it is accessible on all devices through a standard browser.

MegaEdit can be used in both B2B and B2C environments. In the business-to-business market, the system administrator can customize the template so that certain elements are locked down, and therefore the end user will still adhere to the brand guidelines. The business-to-consumer user can exploit a blank canvas to achieve any design they wish by taking advantage of the rich palette of text and image controls including image FX and photo filters, clip art galleries, image masks, and layering.

Due to the browser-based nature, it eliminates the need to download an application that often has to adhere to hardware specifications and requirements. Hosted in the cloud with expandable architecture, the MegaEdit platform is an enterprise level solution that can adapt to any size business.

Personalization is at the heart of MegaEdit. Infigo stresses how malleable MegaEdit is as an integrated solution. The extensive API allows for third party vendors to easily integrate with MegaEdit. This can range from MIS providers through to segregated data feeds enhancing both the printer's and the end user's experience.

Meteor Unlimited Colors

MGI Digital Technology • Melbourne, FL • www.mgiusa.com

Based on the original MGI iFOIL award-winning technology, the iFOIL T is a digital toner foiling solution for the postpress print enhancement market. MGI Meteor digital presses can be fully integrated with the iFOIL T module to create a Meteor Unlimited Colors inline printing & foiling solution. Print Service Providers (PSPs) are now able to produce output with a virtually unlimited number of colors via the blending of CMYK toner and the reflective qualities of foil film, including a rainbow spectrum of hues with metallic, glitter, and holographic effects.

The Meteor Unlimited Colors system uses a 100 percent digital production process. This unique integrated printing press and postpress foiling system eliminates the cost and need for die making, screens and traditional makeready setup times and waste. A wide variety of standard market foils—colors, patterns, and designs—can be used to create brilliant special effects in a single pass. Since MGI does not impose click charges on Meteor presses, multiple passes can be cost-effectively used to create remarkable toner-over-foil blends of color

and light on a diverse range of substrates including uncoated and coated paper, laminated surfaces, plastics, and many other synthetic materials.

The iFOIL T module connects inline with MGI Meteor Presses. Printing jobs can be embellished with the original foil color via a fusion of toner and foil adhesion to the substrate surface. Applications include logos, shapes, text, lines, and highlights.

With no click charges involved, printers can also overprint the foil applied during the first pass with another application of CMYK toner to create a limitless kaleidoscope of tints and hues, as well as precise spot coats to match colors generated from other environments.

The light-reflecting qualities of gold and silver foil provide a powerful foundation for expanding the gamut of effects to a virtually unlimited color range.

Xerox® iGen 5 Press

Xerox Corporation • Webster, NY • www.xerox.com

The Xerox® iGen 5 brings new enhancements to one of the most available and productive digital press platforms in the industry. The press is among the most productive digital presses on the market, thanks to unprecedented levels of automation and intelligence built into the press from end-to-end.

The automation features include closed-loop technologies and press routines that not only provide feedback to the operator but automatically correct the system. These technologies include the Color Maintenance Tool, Auto Carrier Dispense, Auto Density Control, and the Auto Image-on-Paper Registration Tool. The Xerox® iGen 5 Press unites all the elements of the previous versions of the iGen family into a single, ultimately configurable platform. This new press architecture lets customers choose the exact configuration they need to succeed. They can choose the speed (90, 120, or 150 letter/A4 equivalent impressions per minute), the number of colors (four or five print stations), and the feeding and finishing options that best suit their needs.

There is also an optional Thick Stock Capability that expands the iGen 5 Press's already wide media latitude up to a 24 pt (610 microns or approximately 530 gsm). This next generation kit enables a single system to print from 60 gsm to approximately 530 gsm with little downtime. The iGen 5 Press's new architectures also enables the option for a fifth color that dramatically increases the ability of users to match a wider variety of PANTONE colors. The ability to quickly load orange, green, or blue as a supplement to CMYK extends the press's gamut and makes it easy to match a wider variety of spot colors—helping users' ability to keep print buyers on-brand. A typical CMYK process (ink or toner) can match about 55%–60% of the PANTONE Library within 3dE; the iGen 5 with the three gamut extending colors can hit 91percent of the Pantone library within 3dE.

Impika® Inkjet Presses

Xerox Corporation • Webster, NY • www.xerox.com

The Xerox® Impika® Inkjet Press platform consists of a series of product configurations which are built from a set of common attributes. The platform allows flexibility to customize a configuration that is tailored to the customer's environment and applications. With upgradeable configuration ranging from monochrome only to full color, 416 up to 833 feet per minute, single or tandem tower printing, and options such as MICR and VHQ mode, the Impika platform is designed to be fully scalable, meaning the customer's initial investment can easily be upgraded over time as their operation grows and new product innovations come to market.

The modular approach to the platform presents itself in three products. The most popular model, the Impika Compact, is the smallest of the configurations, with single engine duplex printing with full web width of 20 inches. This enables a low cost of entry without compromising performance. At the other end of the spectrum is the Impika Evolution. Customers with the most demanding print volumes and image quality requirements benefit from its printing speeds of up to 833 feet per minute and (Very High Quality) VHQ mode. Customers with unique requirements such as MICR or extreme scalability needs are best suited for the Impika Reference.

The Impika systems offer a wide range of settings to help customers optimize the quality and productivity as well as control their costs. The piezo electric drop-on-demand print heads offers a choice of three resolutions—360 x 600, 600 x 600, and 1200 x 600 and five drop sizes—3, 6, 9 11, and 13 picoliters—meaning each application can be adjusted on the fly with the settings that best meet its requirements. This flexibility allows customers to right size the settings for each and every job. High density inks have been specifically optimized for performance on plain offset grade papers meaning the inks deliver brilliant image quality and color without the need for expensive inkjet treatments and coatings, keeping paper costs low. The long open time of the ink minimizes the need to clean cycles, which keeps productivity to a maximum and ink waste low, while also maintaining image quality by minimizing missing jets.

Integrated PLUS Color Management

Xerox Corporation • Webster, NY • www.xerox.com

The Xerox IntegratedPLUS Automated Color Management Solution is comprised of three major components: a print engine, digital front end (aka RIP, for example EFI Fiery), and SaaS Color Management partner offering. The Xerox IntegratedPLUS Automated Color Management Solution is offered with two cloud offerings, CMI SaaSColorManagment.com and CGS's Oris Certified // Web and Oris AxCM/Lynx.

The solution API has a "client side" (e.g. SaaSColorManagement.com) running in the cloud and its local client software, which interacts directly with the cloud servers and isolates the customers printers/DFEs from the public internet.

The server side is what gives the solution its uniqueness. It provides a compliant remote color management application (SaaS) programmatic access to the internal color management resources on both the DFE (ICC Profiles and Spot Color Tables) and if the print engine is equipped the inline spectrophotometer.

Key server side/DFE features include:

1. Xerox IntegratedPLUS Automated Color Management Solution Feature License (EFI and FFPS)
2. Remote access to internal printer ILS (EFI and FFPS)
3. Remote install of ICC profiles (FFPS)
4. Remote install of Spot Color Libraries (FFPS)
5. Workflow Verification (FFPS)

When Xerox IntegratedPLUS Automated Color Management Solution was conceived, the idea was to do two very important tasks in color management; 1) provide remote access to DFE color management resources and 2) automate the collection of spectral data. The x in solution stands for the three modes of collecting spectral data—critical for color process control. The solution supports all three modes in the field today.

The Magazine

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Open XM/PersonalEffect TransMedia

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Providing an integrated and consistent brand experience across all channels, with no trade-off in presentation or design, is XMPie's objective. The software is engineered to provide openness for developers of digital media to use any web design or web development environment.

Open XM is presented as the new technological foundation for personalizing the online touch points of a multichannel campaign that now powers XMPie's Cross Media Product, PersonalEffect TransMedia, an all-in-one solution for creating, managing, and monitoring multichannel 1:1 campaigns. This fully integrated solution controls all touch points across all media: print, email, Web, and SMS for the production of sophisticated cross media campaigns that offer complete brand control and messaging synchronization regardless of communication channel.

As a reflection of the fact that print design today is almost exclusively done using Adobe software, for all print campaign touch points, XMPie personalization software is integrated into the Adobe Creative Tool Suite (InDesign, Illustrator, and Photoshop).

Digital design, on the other hand, has no single exclusive design tool that everyone uses universally. Therefore, for this product upgrade, we have rethought our approach to digital personalization and designed a ground breaking new technology—Open XM.

Open XM provides a technology stack for accessing the XMPie personalization engine for the purpose of creating personalized digital touch-points. Open XM does not force the use of an XMPie proprietary design tool for the online touch points, rather it can be used with any of the latest web design tools and development environments.

Importantly the personalized content in every touch point—both print and digital—is always synchronized perfectly with each using the same database and logic rules, and the user experience can be the most advanced and creatively compelling for each media type.
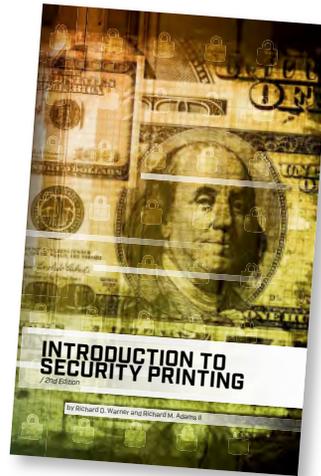
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TECHNOLOGY

CONSUMER PRODUCT GOODS AND VERIFICATION PROCEDURES

Richard D. Warner and *Richard M. Adams II*

The following excerpt is from Introduction to Security Printing, Second Edition. *Published in 2016, this work explores what is currently available in new digital printing technologies and explores how they can be used effectively to convert digitally printed products into security documents, labels, and packages. The section below looks at risk management issues in security packaging and labeling.*

One risk management issue that is common to brand owners, consumer product goods (CPG) companies, package/label security end product converters, and to security document originators/security document printers is failure risk and the resulting financial losses/compensations resulting from counterfeits, knockoffs, and/or forgery attacks. However, brand owners, CPG companies, security packaging, and label printers also deal with social risks as many of their products are edibles for human and/or animal consumption, such as foods or prescription drugs, or business-to-business products such as automobile parts, airplane parts, life-support equipment, etc., where counterfeit/knockoff substitutes fail and often result in loss of human/animal life and subsequent financial compensations amounting to several hundreds of millions of dollars.

Brand owners and CPG companies often suffer counterfeit attacks from organized crime, white-collar criminals, and terrorists. Keep in mind that the intellectual property cost for patents, trademarks, trademark colors, copyrights, product development, and marketing costs have already been paid for by the brand owner, the

security printing technology researchers/developers, or the security printing packaging and labeling consumables developed/manufactured and distributed by business-to-business security paper/board and ink/coating suppliers.

The organized criminals, white-collar embezzlers, and terrorists are most often highly educated professionals who blend in well with the industrial or educational communities. They look for good returns on their investments and a low risk of being caught with low-risk penalties. They strive for a high value Crime Selection Index (CSI). Brand products with little or no security protection are their favorite targets.

These professional embezzlers often show up in manufacturing industries with complex distribution chains and may be producing brand name products under license from the brand owners for two shifts during the work day, but operate a non-licensed third shift and sell/distribute these same unlicensed products right along with the licensed brand products. Motorized vehicles (cars, motorboats, motorcycles, airplanes, etc.) often use several independent machine shops for various parts to be assembled at their main manufacturing headquarters. Often these parts made at job shops are produced out-of-license or simply substituted with counterfeit parts. Thus, brand protection programs not only need to have protocols to be able to verify the packages and labels as being authentic, but must also provide

covert/forensic taggants embedded within the branded product itself.

There are case histories of organized criminals having their own manufacturing/distribution organizations that make well-known over-the-counter (OTC) innocuous products such as face cream. These products may be sitting on the shelves at your local drug store next to brand-name products that may have been delivered by the same distribution company. This type of illegal activity by the criminal is known as "diversion." Its goal is not to make money selling knockoff face cream, but to launder illegal monies made from drug trafficking and to fix their accounting books to pass IRS tax return investigations.

Security Printing: Packaging and Labels vs. Documents

Although security packaging and label converters often use the same suppliers and manufacturers as their counterparts in document security, the distribution chains, risk management issues, converting processes, and state and federal mandates do require that they be discussed and treated as separate entities.

It is not unusual to find security packaging and label converters using the same analog or digital printing equipment, the same software (e.g., Photoshop), the same page layout and imposition equipment/software, and similar consumables such as security printing inks/security coatings, security toners, and the like, as do security document printers.

THE CONTINUOUS-FEED PRODUCTION INKJET MARKET / 2016

I.T. Strategies
The following is an executive summary of a full-length report released by I.T. Strategies.

Eight years after the introductions of the first generation of models, the dynamics of the continuous-feed production inkjet market are changing. While growth continues to be strong overall, there are nuances that hide some of the trends in sub-segments of this market. Most noticeably, while total engine sales were up 8 percent worldwide in 2015, if one excludes the explosive growth of entry-level printers, the core mid/high-volume engine market actually declined by 5 percent. Note, however, that significant new placements continue to be added into the installed base, and page-volume growth is stronger than ever.

I.T. Strategies believes the decline in mid/high-level production engine sales is a reflection of the inability of the next group of prospective first-time inkjet buyers to justify what is often a $2-million-plus investment once software and finishing are included. Conversely, about one-third of those who have adopted previously tend to be repeat buyers.

The market for continuous-feed production printers has moved from the early adopter phase to a mainstream phase, and the number of offerings is proliferating. New segments in 2015 include cut-sheet production printers (not included in our forecast data, as only a single vendor shipped product in 2015 and I.T. Strategies' policy is not to publish market share), and what we are calling graphic arts printers. The impact of the entry-level continuous-feed inkjet printers has not been as profound on page volumes and revenue as the mid/high-level markets for the simple reason that they represent a smaller portion of the active installed base.

We've summarized below some of the highlights of the forecast implications on engine, installed base, page volume, and revenues.

FORECAST

There are many ways to quantify and categorize the production inkjet market. In an attempt to equalize the units measured as best we can, I.T. Strategies has settled on tracking engines rather than systems based upon hardware acquisition price and corresponding print volume capacity.

- **Entry-Volume:** The under-$600,000-per-engine category includes models such as the Ricoh InfoPrint 5000MP and Xerox Rialto 900.

- **Mid-Volume:** The $600,000-to-$1,250,000-per-engine category includes models such as the Canon ColorStream, Ricoh Infoprint 5000, and HP T200 Series.

- **High-Volume:** The over-$1,250,000-per-engine category includes twin engines with speeds of 150 meters/minute or faster such as the HP T300 Series, Océ Jetstream 2200, and Xerox CiPress 500.

- **Graphic Arts:** The graphics arts category includes systems with in-line anilox pre-coaters enabling print onto offset stocks such as the Kodak Prosper 6000, Ricoh Pro VC60000, as well as the units that claim to offer high print quality/high coverage without a pre-coat such as the Canon ImageStream series and Dainippon Screen TruePress Jet 520HD. The key distinction is that these systems are intended to print on offset coated stocks, with an even higher level of print quality than that offered by the other continuous-feed production printers.

The unit growth rates for each segment vary depending on the stage of the life cycle, averaging 12 percent compounded annually for the market in total. The entry-volume is projected to grow at 15 percent from a low initial base. The core market, the mid-volume, is projected to grow at 9 percent. The high-volume segment is projected to grow at 8 percent as large users continue to add capacity at above-market growth rates. Finally, the graphic arts segment, which we caution still needs to be proven technologically in commercial operation, is projected to grow at 35 percent with the assumption these systems deliver performance as intended.

ENTRY-VOLUME

One key reason the entry-volume printers carried engine growth in 2015 was that transaction print providers with multi-installation, aging continuous-feed toner systems are reaching a stage where they have no choice but to upgrade. Due to the greater productivity of inkjet systems, 2–4 continuous-feed toner systems can be replaced with a single continuous-feed inkjet printer, reducing their maintenance and running cost. The new cut-sheet production printers that started shipping in 2015 for the first time should have a big impact in 2016 on mono, cut-sheet toner replacement as well in in-plant environments.

MID-VOLUME

These systems continue to form the core of the market, accounting for about half of all systems sold in 2015. Typically running between 75 meters to 128 meters per minute, they hit a sweet spot for most transactional and direct mail printers in terms of volumes needed to

justify a strong return on investment. Inkjet has sustained the life of transactional statements through the ability to add variable color/graphics.

Looking forward, this category is under pressure from even more productive continuous-feed inkjet systems adopted by some of the larger transactional statement providers and direct mailers. By 2020, I.T. Strategies is projecting an installed base of 3,736 engines, a reduction of approximately 10 percent from last year's projection. By comparison, the average monthly print volume of the mid-range segment continues to grow, as utilization of these production printers gets even better. This results in page volume growth rates of 21 percent, but does suppress demand for new engines.

HIGH-VOLUME

This is the segment that is betting on the displacement, and in some cases conversion, of offset pages. While engine growth is modest at a projected 8 percent CAGR, these machines are so productive (in large part due to print widths greater than 20-in.) that the average system is projected to print over 30 million pages per month by 2020. There is significant room for growth even at those rates, as by 2020 digital printing will still only account for 10–20 percent of all direct mail. Book pages follow a similar pattern, and some of these printers are also entering into select packaging applications, a market for digital printing which will provide even greater upside than document printing in the long term.

GRAPHIC ARTS

This segment is the core of incremental future revenue growth for production inkjet printers. Without the capability to print on offset stocks at high volumes of ink coverage, it will not be possible to capture significant page volume. While several recently introduced models profess to have this capability, we should recognize that their capability to print on offset stocks does not mean all offset stocks. There are still many uncertainties at this early stage of development about actual ink coverage, ink cost as part of the total cost per print, etc. This is a dynamic segment and may become difficult to quantify if it becomes common for technology upgrades to convert standard systems to graphic arts systems.

The real significance of graphic arts printers is the revenue they are projected to generate. Due to higher ink coverage, I.T. Strategies expects this segment's 7 percent share of total pages printed to generate 16 percent of vendors' revenues by 2020.

PAGE VOLUMES

I.T. Strategies has continued to project the amount of pages printed by 2020 slightly below the previous 2015 forecast projections. This is not a prediction based upon decline in demand, but rather a constraint imposed by the continuing uncertain outlook in the print industry overall, which affects the ability for print shops to finance capital equipment.

It is possible that this assumption is too conservative, as the forecast has not made any assumptions about packaging volume growth. It also makes no assumptions about potential challenges finding skilled labor to operate existing offset presses, nor does it make assumptions about exigent postage cost increases, which could drive more static offset printed direct mail volume to higher relevancy, digitally printed direct mail.

CONCLUSION

Continuous-feed inkjet production printer technology remains among the fastest growing markets for equipment manufacturers and print providers, especially in relation to most other print market segments. Total revenue growth is expected to average 14 percent annually for the next five years. It may well grow even faster than projected in our forecast here, providing some of the ink coverage and total-cost-of-print challenges get solved sooner than expected. In all, there continues to be a very positive outlook for the continuous-feed inkjet production market.

DRUPA 16—A WATERSHED EVENT

David Zwang, *Principal Consultant, Zwang & Company*

Now that I have had a chance to recoup from the marathon called drupa, I wanted to share some thoughts and highlights. I have been to eight drupas since my first one in 1986. As a result, I have been witness to many developments that have impacted our industry over that time, including the move from analog design and prepress to digital, the first wave of digital EP presses, and many other incremental developments that have led us to where we are today. Although for me, drupa 2016 showed more promise for the future of graphic arts than any of the others I can remember. I would even go so far as to call it a watershed event, although it really did take years of incremental and parallel development efforts in many areas to get to this point.

The excitement in the Messe during the show was palpable. While the total visitor count for the show was down from 2012, this was probably attributable to the shortened length of the show. In fact, the visitors per day count this year was actually up. More importantly, the vendors had very innovative products that are much more compatible with the future and the changing requirements of print production and content distribution. For the attendees, there was a willingness to purchase—in many cases they did it with a vengeance, planning the new direction and retooling of complete plants of equipment.

This excitement was in part driven by the availability of "true digital" end-to-end workflow, equipment solutions, and processes. This starts with the design process; continues through order entry, plant scheduling, and automated or semi-automated production; and ends with finishing, tracking, shipping, and invoicing. The interesting and perhaps more important part is that while this could be done with single vendor systems in the past, now it can be accomplished with disparate systems and equipment. Increasingly this is crucial, since purpose-design systems are increasing in demand, and would usually require multi-vendor approaches.

The arrival of production inkjet beyond its traditional transactional, direct mail, and book markets was apparent throughout the show, and not just in continuous feed web presses, but also multiple sheetfed solutions. Heidelberg showed impressive results with their Primefire B1 sheetfed production inkjet press, although they also showed their XL 106 offset press, which achieved makeready and printing of three 16-page forms in about seven and a half minutes. With that kind of performance, I expect that they will be selling offset presses for a while.

There were other sheetfed production inkjet presses being offered for sale and delivery, including the B2 Fujifilm Jpress 720S, the A3 Canon Océ VarioPrint i300, and the new Xerox Brenva B3+ Press. Additionally we were introduced to the Canon Voyager, a surprise technology demo. This seven-color, B2 sheetfed "offset" production inkjet press was running at 3000 sheets per hour (sph) and producing photographic quality print on a wide variety of untreated substrates. I am looking forward to seeing where they take this.

If you have been reading articles on production inkjet, you know non-UV ink availability that will support lots of non-treated substrates, especially offset coated, has been one of the constraints to rapid adoption. We are finally starting to see significant developments in inks that can print on untreated offset coated stocks, most recently with the introduction of the new Xerox High Fusion inks on their continuous feed Trivor web press and Canon with their latest ink set available on the ColorStream. We expect to see more availability of these type of ink advancements in the very near future, although as in offset there will probably always need to be specific inks or pretreatment for certain types of media. Even the latest press offerings from HP Indigo can include media pretreatment support.

The diversity and volume of production inkjet corrugated press applications was a bit of a surprise, but in retrospect it makes perfect sense. Corrugated board is more economical than solid bleached sulfate (SBS) and other folding carton substrates, and even more so if you can potentially eliminate the need to double box a product for shipping. EFI, HP, Durst, and others showed a range of corrugated solutions.

To address the growing application purpose design requirement, there were many hybrid solutions that combined different printing and/or finishing processes. A couple of examples are the new built-to-order B1 format KBA VariJET 106 Folding Carton press powered by Xerox and the HP Indigo Digital Combination press, designed for flexible packaging production. With the increased availability of modular OEM inkjet component solutions from Kodak, HP, Xerox, Memjet, and Xaar, there were lots of unique application specific solutions shown, and we can expect many more to come.

In line with application purpose design, one of the more interesting trends to watch will be the integration of print solutions directly into packaging lines. Historically the production model was that you print labels offline and apply them inline on a container as a part of the

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product manufacturing process. Now we are seeing solutions either directly or as OEM products from Agfa, Heidelberg, HP, Xerox, and many others that actually print directly on the packaging regardless of the shape or material. This adds significant flexibility for consumer product companies to deliver smaller and more targeted products to the market. This new availability is really driving tools for mass customization. Look for these types of solutions to also begin the erosion of flexo in certain applications.

However, this hybridization trend goes beyond the print production process. Dalim, Agfa, and Xerox all showed solutions that support multi-channel publishing from print PDF files. We are also starting to see it in the development of fairly narrow scope application specific pressroom management software as an alternative to full-blown MIS or workflow systems. An interesting example is a cloud-based standalone solution from SpencerMetrics for measuring productivity in the pressroom. This new modular approach to business and production management is also evident in a solution by Ironsides Technology, which focuses on production tracking. Of course, applications like Enfocus Switch make the integration of these and many other new modular solutions much easier.

As is always the case with drupa, it is important to separate the hype from the reality of what is being shown and said. I was surprised to

see that while there were a lot of "technical demonstrations" of new concepts, the vast majority of products and solutions shown were either available for sale and delivery today or within the next six months. This means that once again the industry is poised to go through some major transformations.

Even more exciting is that drupa 2016 was not the end of this new wave of innovation but just the beginning. Beyond the hype, and exhibits that were behind black curtains for the select few to see, there are many more products and solutions that never even made it to Dusseldorf.

About the author: David Zwang travels around the globe helping companies increase their productivity, margins, and market reach. With over 40 years of industry experience, Zwang specializes in process analysis and strategic development of firms in the fields of publishing, design, premedia, and printing across the globe. His expertise in production optimization, strategic business planning, market analysis, and related services to companies in the vertical media communications market has transformed many businesses. He sits on many international standards bodies and is currently the Chairman of the Ghent Workgroup.

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THE INFLUENCE OF PRINT SEQUENCE ON EXPANDED COLOR GAMUT

Dr. Liam O'Hara, Associate Professor, Department of Graphic Communications, and Bobby Congdon, Clemson University

Over the last ten years, expanded color gamut printing (ECG) has seen a rapid rise in adoption by packaging printers in narrow and wide-web flexography, offset lithography, and digital print applications (toner-based and inkjet). ECG offers printers the opportunity to reduce their reliance on spot color formulations to achieve the brand color demands of consumer product companies. Spot colors have been the traditional solution for high-chroma, high-impact colors for logos and brand recognition—three to four spot colors in addition to four-color process are not unusual in today's packaging. While some spot colors can be replicated with traditional four-color process, the chroma that can be achieved for many hues is limited, and subsequently four-color builds often fail to achieve the desired vividness that is required. The Pantone Color Book is a common reference for spot colors; approximately 40 percent of the Pantone book can be replicated using the GRACoL2006Coated1v2 printing gamut. Pantone claims that 90 percent of the Pantone book can be replicated using CMYK supplemented with orange, green, and violet ECG. For flexographic printing, testing performed at Clemson University demonstrated that a CMYKOGV ink set yielded 72 percent of the Pantone library with an average ΔE2000 of 1.39.

The use of ECG enables printers to dramatically reduce makeready and tooling costs, particularly where jobs can be ganged together. These economic drivers have bolstered the adoption of ECG in packaging—a 2013 Flexographic Technical Association (FTA) survey indicated that adoption of ECG among packaging printers was about 15 percent, and one industry projection suggests that market share could grow to as much as 40-50 percent by 2020. In addition to flexo markets, ECG adoption is also growing among litho printers in the folding carton segment and digital presses—toner-based and inkjet—as well.

THE CALL FOR STANDARDIZATION

With this proliferation, the need for standardization becomes increasingly important to brand owners to ensure consistent results from printers. Towards this end, the FTA has specified pigments and hue angles for CMYKOGV ink sets

(depending on whether the formulations are water-based, solvent, or UV inks) in their FIRST specifications (FIRST 5.0, 2015).

Clemson University has been conducting seminars on ECG for flexo for several years, and one of the recurring questions from printers adopting ECG is what print sequence to use. Subsequently, we set out to provide some data to answer that question. In press trials, a change in print sequence in two-color overprints created color differences as great as 9.5 ΔEab. In this study (O'Hara, 2016), three print sequences were tested with the aim of placing the OGV primaries before, between, and after their analogous process colors: KCMYOGV, KOGVCMY, and KCGVMOY. It is standard practice at Clemson to print KCMY, and we elected to restrict the print sequence study to the placement of OGV within that sequence, a decision motivated to limit the number of press runs for the experiment. A fourth sequence, KYOMGVC, was added to investigate the "between" strategy with the process colors reversed, to provide data on MOY and YOM (for example). Esko Equinox Profile Creator software was used to create the seven-color profiles, and Esko Color Engine Pilot was used to compare the resulting gamut volumes.

THE PRINT SEQUENCE RESULTS

Changing the print sequence does indeed have an impact on the overall print gamut and the number of colors that can be reproduced. **Figure 1** shows the resulting volumes expressed as a percentage as compared to the smallest gamut. The cubic L*a*b* units are indicated on the y-axis. These trials indicate that the print sequence can change the gamut volume by as much as 7.7 percent.

FIGURE 1. GAMUT VOLUMES FOR THE PRINT SEQUENCES
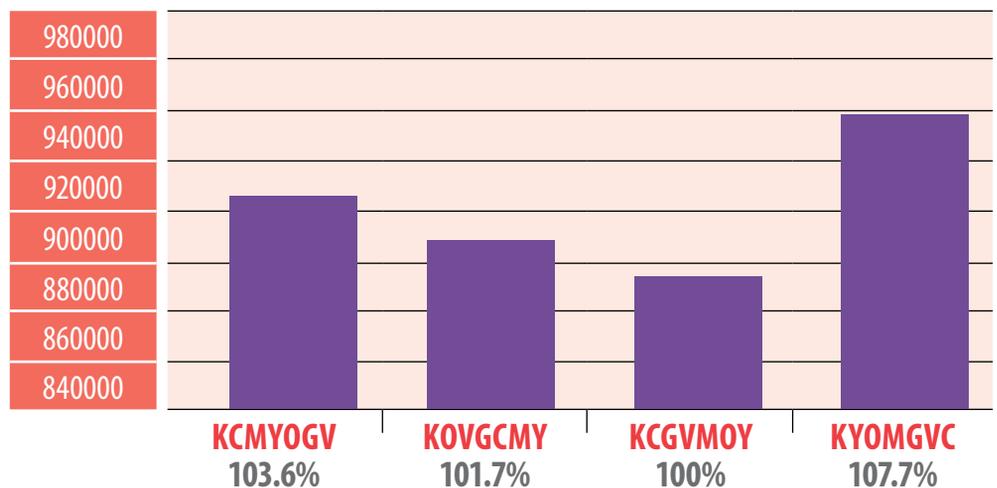
KCMYOGV 103.6%	**KOVGCMY** 101.7%	**KCGVMOY** 100%	**KYOMGVC** 107.7%

Interestingly, the opacity of the color primaries proved not to be indicative of the print sequence. The conventional wisdom is that more opaque inks should be printed first, with higher transparency inks overprinting them. The opacity of the primaries in this study, from high to low, were as follows: V—15.71, O—10.48, M—6.34, Y—4.83, C—4.06, G—3.76. The closest sequence printed in this study to this scenario was the KOVGCMY, which has violet and orange printing before their process color pairs. Violet and orange are 2–3 times as opaque as the other inks; however, as **Figure 1** illustrates, placing orange and violet first yielded one of the smaller gamuts, which suggests that sequencing based on the opacity of the primaries does not yield the optimal gamut. This led us to look for other means to model and predict an optimized ECG print sequence.

TOWARDS A PREDICTION MODEL

We adopted a geometric approach based on the L*a*b* values of the primaries and the overprints to calculate the volume of each color sector. The three points of the two primaries and the subsequent overprint are combined with an L*min and L*max to create a three-dimensional shape. L*max is defined by the white point of the paper, but L*min can be a moving point due to the fact that its commonly a build of black and another color (a rich black rather than 100 percent black). This could result in the black point of the various color pairs

overlapping or leaving "gaps" in the overall gamut. So for this model, a common, neutral black point was selected: L* = 9.5, with a* and b* being 0. It is recognized that the true black point may not be captured in this fashion, but the goal of ECG is to expand chroma, not the black point, so we assumed that a common black point would serve the purpose of analyzing the difference in gamut expansion.

Space does not permit a full explanation of the volume calculation, but that can be found in the *Proceedings* from the 2016 TAGA Annual Technical Conference (O'Hara, 2016). Once the volume of each color sector for a particular print sequence of the overprint has been determined, the larger volume suggests the optimal sequence for that particular color pair. Of course, this is a simplified model for the gamut sector as it reduces the shape to straight lines and flat planes, whereas the actual shape of a gamut sector is a curved geometry due to factors such as TVI, trapping, and hue error, but to calculate the curved geometry would be prohibitively complex. The advantage of this approach is that it should allow one to determine the print sequence based off of drawdowns rather than investing in press runs.

Working from the printed overprints from the various experimental sequences, the overprint sector volumes for each color pair can be determined. The resulting print sequence based on overprint sector volume in this experiment was KOYGCMV. It is interesting to note that

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the certain pair sequences have greater significance than others. For example, the sequence of yellow and green had a change in volume for that sector of 4.04 percent, whereas violet/cyan sequences only change the sector gamut volume by 0.01 percent. The other pairs varied as follows: magenta/orange 3.71%, cyan/green 1.24%, magenta/violet 0.42%, and yellow/orange 0.03%.

Of the four print sequences performed on press, none of them actually matched the result of the predictive model (which was developed after the press trials were conducted). However, the predictive model does accurately rank the volume of the four printed sequences in the same fashion, and a comparison of the predicted volumes and the printed volumes shows that they are relatively similar. Again, the predictive model is a simplified geometry of flat planes, as opposed to the curved contours of the actual gamut. **Figure 2** shows the calculated volumes and actual printed volumes for comparison.
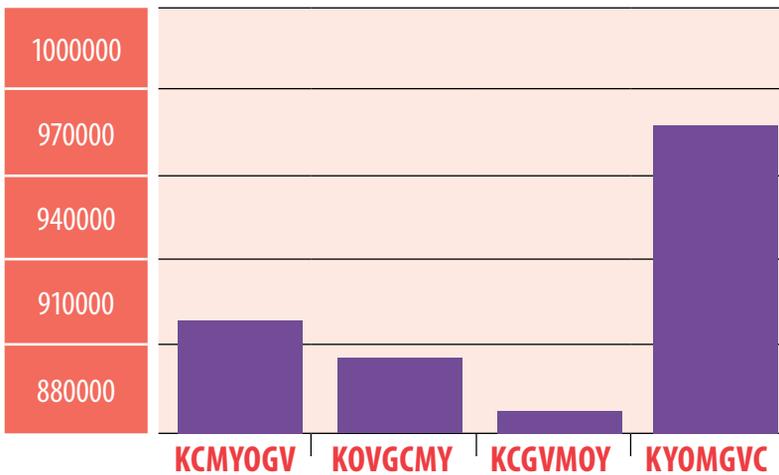
CONCLUSIONS

While the issue of a standard print sequence for ECG is an ongoing challenge, we are hopeful that the predictive model developed will allow printers to work from a set of drawdowns of primaries and their overprints to optimize print sequence without the expense of multiple press runs, regardless of whether they use standardized OGV to supplement CMYK or if they adopt other spot colors into an ECG strategy. Future research will explore the application of this methodology to n-color and modified process situations.
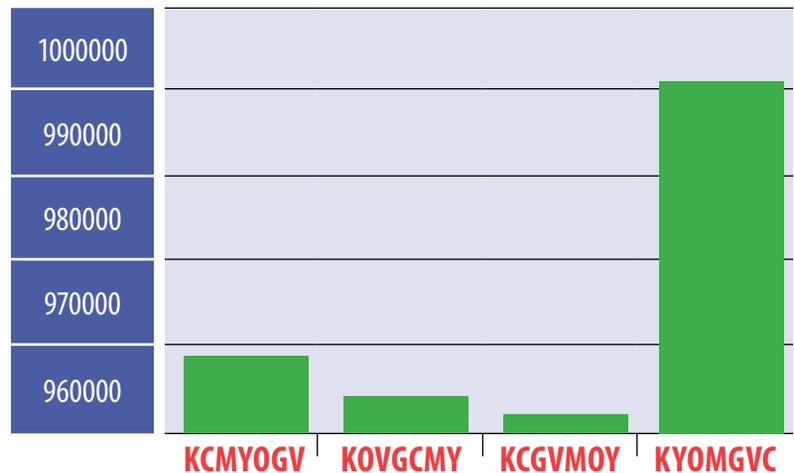
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FIGURE 2. ACTUAL VOLUME VS. MODEL VOLUME

ACTUAL VOLUME

1000000			
970000			
940000			
910000			
880000			
KCMYOGV	KOVGCMY	KCGVMOY	KYOMGVC

MODEL VOLUME

1000000			
990000			
980000			
970000			
960000			
KCMYOGV	KOVGCMY	KCGVMOY	KYOMGVC

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