

Expanding The Gamut



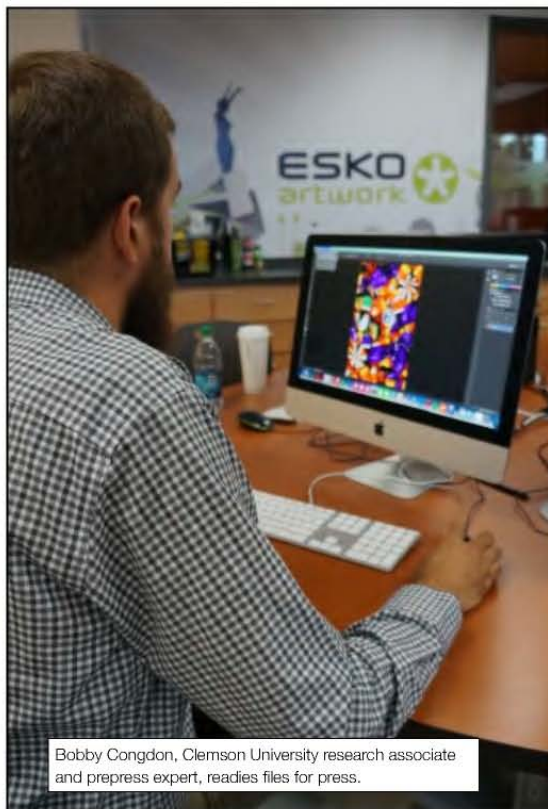
FLEXPLO® Cover Project Showcases 2014 Technical Innovation Award Winners

Robert Moran

Conceive. Design. Optimize. Execute—in other words, print. As easy as that sounds, it's bound to conjure up some challenges, especially when you take a non traditional flexo print job—say, a magazine cover form on a substrate designed for the lithographic market—print it two sided on a narrow web press lacking a turnbar, coat it with varnish, selectively expand the color gamut and present it side by side with a mirror image printed in CMYK.

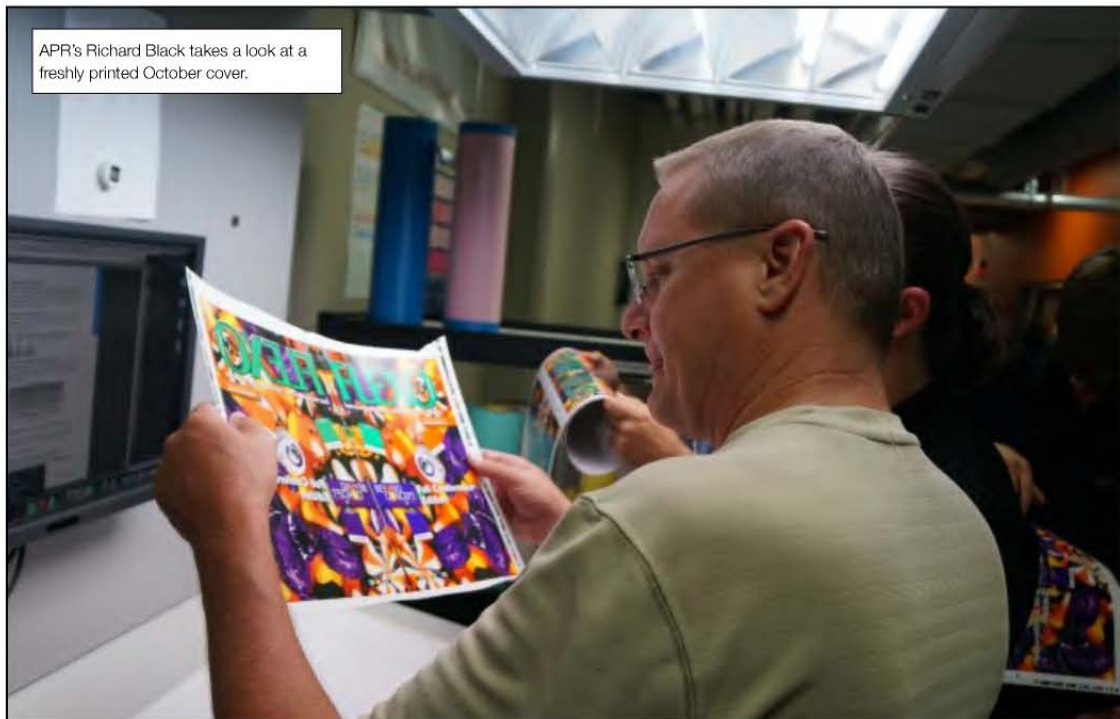
Challenging? Yes. Impossible? No! Achievable? Definitely. Innovative? Absolutely—all by design. The idea took root with the announcement of Flexographic Technical Association's 2014 Technical Innovation Award winners (see **FLEXPLO** May 2014, page 30 and page 34).

Both Esko's Equinox Expanded Gamut Technology, and All Printing Resources' and Spot On! Press' SpotOn! Flexo were designed to expand the packaging industry's horizons, while taking the guesswork out of color matching (see sidebars accompanying this story). So, it seemed logical to demonstrate the process via a live production, 7-color print job, for all to see.

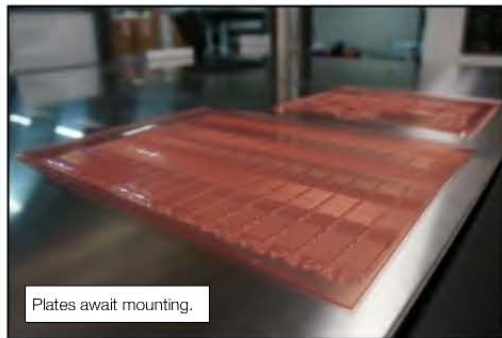


Bobby Congdon, Clemson University research associate and prepress expert, readies files for press.

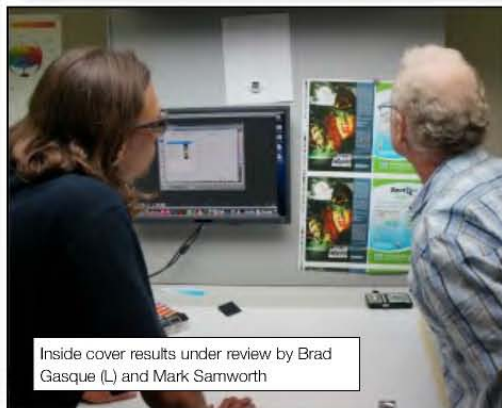
APR's Richard Black takes a look at a freshly printed October cover.



Makeready: Brad Gasque prepping a print deck with Jason Cagle looking on.



Plates await mounting.



Inside cover results under review by Brad Gasque (L) and Mark Samworth



Students Travis Thurler (L) and Scott Rickard (R) observe Clemson's Brad Gasque preparing the press.

PROJECT PARAMETERS

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Assembly of the team started with the obvious. **FLE XO**® approached Mark Samworth, color product specialist at Esko, and Richard Black, director, digital solutions at APR (they held critical roles in the development of the award winning technologies) with an initial query as to their interest. Both were onboard at the onset of the conversations. Steps two and three: expand the project team and identify a logical printer. Action was swift in all respects.

With a team in place (see roster on page 22), the initiative required a series of conference calls, beginning with selection of an image, enhancement of that image, application of featured technologies to page files and eventually culminating in the Aug. 19 fingerprinting

and optimization run, Aug. 20 front side print/varnish, Aug. 21 back side print and later the varnishing of the inside covers. With the actual printing accomplished, a shipment was sent off to **FLE XO**®'s regular partner, Cummings Printing of Hooksett, NH, for sheeting, folding and binding.

DESIGN & DEFINITION

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With the project defined as a demonstration of a 7-color EG print job in flexo, the search was launched for a cover image that would best exemplify the intent. Emphasis was placed on significant incorporation of orange, green and violet in the color scheme. Several options, put forth by Katie Dubois, FTA's creative services manager, were reviewed internally and the field was narrowed to two.



FLE XO®'s cover project began with the all important fingerprinting and characterization pressrun.

Both options were disseminated to print and supplier partners and a selection was made based on the image's strength in boldly portraying EG print. Creative license was incorporated in accentuating the violet and introducing color swatches—complete with adhesive tape attaching them to the art—making the job just a bit more difficult.

Chip Tonkin, director of Sonoco Institute of Packaging Design & Graphics, Clemson University, observed, "When FTA contacted us about the possibility of printing the cover of FLEVO' magazine, we were very excited. It was an opportunity to do something real, and forced our students and faculty to overcome difficulties in all areas of the supply chain from material acquisition and characterization, prepress workflow, color management, proofing, process control and production printing. Most of our projects offer individual challenges in prepress and/or color management, but this was an actual job with hard deadlines and very high customer expectations. We couldn't be more pleased with the result and look forward to doing more of this kind of work in the future."

OPTIMIZING PLATES & SCREENS

Rory Marsoun, vice president, market development at Esko, stated, "When I first saw the artwork, I thought, "This is going to be a challenge. There's a lot of bright colors, solids and there's a lot of highlight areas."

He continued, "For this project, we used our newest technology—Full HD Flexo. It allows you to have the benefits and the solids of a flat top dot, while still keeping the primary benefits of round top dot in the highlight. I was [at Clemson] a week early, working with DuPont, to make sure the plates were being exposed under the correct conditions and we had everything set up right. We wanted to make sure we were printing the smallest dot we can, to end up with a nice, smooth transition to zero.

"We ended up printing this job at 200 lpi," Marsoun noted. "There was some testing that went into choosing that lpi. We have very small highlights and, at the same time, very

Technical Innovation in Action

In preparing for and executing FLEVO's October cover project, the magazine enlisted the help of this year's two FTA Technical Innovation Award winners: Esko and All Printing Resources/SpotOn! Press. Simply put, the project would not have succeeded without them.

EQUINOX

Esko's contribution to the cover project came in the form of its Equinox software. It won the 2014 FTA Technical Innovation Award in the prepress graphics category. The company set out to create Equinox after pondering how to reliably and accurately print spot colors using seven process colors instead of four.

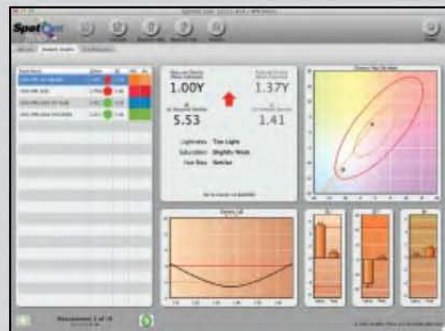
Equinox consists of a suite of software technologies that converts brand colors as well as RGB or CMYK images to 5-, 6- or 7-color process. After studying how to make 7-color profiles using all combinations of CMYKOGV and ICC formats, Esko discovered it could generate more accurate profiles and colors by using 7-color profiles made up of relevant combinations of four colors. Samworth said the four combinations used—CMYK, Omyk, cGyk, cmVk—are capable of color accuracy in the range of custom mixed inks and really shine when applied to photographic images common on modern packaging.



SpotOn! FLEVO

SpotOn! Flexo, a joint effort from All Printing Resources (APR) and SpotOn! Press, was also used in the cover project. The software was recognized with a 2014 FTA Technical Innovation Award in the prepress room category.

Matching spot colors can be done visually—with the human eye—or mathematically—with a spectrophotometer. Variability and the lack of corrective actions make either of these options less than ideal. The companies' solution to this problem, SpotOn! Flexo is a color analysis software tool that uses a predictive analysis algorithm to determine the best ink density to achieve optimum color representation. With a spectrophotometer, "the software compares the spectral data of a color measured on a press pull to the spectra data of the reference color," according to Black. This creates what the companies call "optimal ink density," which informs an operator if an acceptable spot color match is feasible.





Black examines a print sample using a spectrodensitometer.

good solids on the same plate. At the end of the day, my work was done before everyone else got here. When they came in, they started the characterization.”

Courtney Norris, applications specialist at DuPont Packaging Graphics, elaborated on Marsoun’s points. “One of the first steps in this process was optimizing the plates. A big piece of that is selecting highlight screening. In order to do that, we created a couple of benchmark targets for DPR through Full HD and ran a couple of one color targets, then selected the one with the best fade to zero.”

Speaking to materials, she commented, “The plate selected was DPR, which is a Cyrel product. It really is the ideal product for Full HD because it holds very fine elements. It is designed to have a very good fade to zero and holds very fine highlight dots. It has very good solid ink density and good ink transfer. That facilitates very consistent and smooth laydown.”

Employing Esko’s Digital Flexo Suite, Cyrel 0.067-in. DPR plates were imaged on an Esko CDI Spark using Full HD Flexo and processed on Mekrom’s EVO 3 solvent plate system. The back exposure time was 79 seconds and the Full HD Flexo exposure using inline UV in the CDI spanned five rotations over 720 seconds. The plate was processed, then dried for 90 minutes. Full sheets contained three to four images

each and were post exposed and detached. A Camis plate mounter completed the preparation.

CHARACTERIZATION & PROFILES

Samworth indicated, “In terms of color management—getting the ability to match spot colors and images that are in a digital file to the printing press—what we really need are color profiles. We ran a CMYK profile test, then an orange (Omyk), then a green (cGyk), then a violet (cmVk). This is the information that was used to convert colors in the job.

Project Team Roster

Richard Black, Director of Digital Solutions at All Printing Resources, Inc.

Alan Bobbit, Senior Sales Account Manager at Environmental Inks/Siegwerk

Bobby Congdon, Research Associate at Clemson University’s Sonoco Institute of Packaging Design & Graphics

Katie Dubois, Creative Services Manager at FLEXO® Magazine

Brad Gasque, Research Associate at Clemson University’s Sonoco Institute of Packaging Design & Graphics

Rory Marsoun, Vice President for Market Development at Esko

Mark Mazur, Digital Prepress Consultant at DuPont Packaging Graphics

Bob Moran, Publisher at FLEXO® Magazine

Courtney Norris, Applications Specialist at DuPont Packaging Graphics

Brad Pareso, Editor at FLEXO® Magazine

Mark Samworth, Color Product Specialist at Esko

Perry Stacks, Technical Service Representative at Environmental Inks/Siegwerk

Chip Tonkin, Director at Clemson University’s Sonoco Institute of Packaging Design & Graphics

Students

Jason Cagle, junior at Clemson University

Jonathan Kalshoven, senior at Clemson University

Kariahlyn Lindsey, senior at Clemson University

Alexa Rickard, sophomore at Clemson University

Scott Rickard, second year graduate student at Clemson University

Travis Thurler, senior at Clemson University

BEYOND THE CONCEPT:

INNOVATION in ACTION

Several individuals involved with FLE XO's October cover project will be speaking at FTAs 2014 Fall Conference & Tabletop Exhibit, taking place from Oct. 20-22 at Doubletree by Hilton in Minneapolis, MN. They include:

Mark Samworth, Esko & Richard Black, All Printing Resources

Expanded Color Gamut Integration & Automation From Design Through Press: A Live Proof of Concept

This presentation will feature both 2014 FTA Technical Innovation Award winners, discussing their work on the October cover, with copies of the magazine on hand to examine, along with a discussion of the statistical results on color accuracy and variation through the 25,000 copy run.

Chip Tonkin, Brad Gasque and Liam O'Hara, Clemson University's Sonoco Institute of Packaging Design & Graphics

Printed Electronics: Flexographic Applications & Production Issues

Faculty from Clemson University's Sonoco Institute of Packaging Design & Graphics will be discussing a trio of presentations focused on:

- The viability and challenges of functional printing for real world packaging applications
- Printed electronics in the flexographic pressroom
- Printed electronics research at Clemson

"Today, we have many ways of getting curves using modern measurement and algorithmic technology," he added. "We ran a screening test to find the optimum screening for this plate and press combination. We took measurements and found, through sampling, that our color measurements are fairly evenly spaced in $L^*a^*b^*$ value. So, we took our curves from the screening test of the magenta. The target was run from PressSync curve H34—a curve where the 50 percent dot in the original file is reduced to 34 percent on the screened plate file."

Black outlined other steps in the process. "Using SpotOn! software, we imported the reference color data for the CMYK and the green, orange and violet into the software. Then, when we made first press pulls, we measured the color patches with the spectrophotometer. The software compared the spectral data of the reference color to the

measured color and provided the optimal ink density—the only real control we have on press when we need to make a color adjustment.

"We targeted the CMYK colors to the GRACoL 2013 specifications. In actuality, we worked with the ink to change viscosity and lower density of yellow to match the specification," Black continued.

"Magenta was affected by brighteners in the substrate. Since we had a limited time window, we proceeded and let the profiles compensate for differences the software displayed between reference target and the actual print."

Once all the characterizations were completed and optimized, "we entered the color data measured from the profile characterizations in as the new master (reference) colors," Black explained. "This allowed us to create a colorimetric match on the final pressrun based on the profile characterization run."

FILE MANAGEMENT

Bobby Congdon, research associate at Sonoco Institute of Packaging Design & Graphics, Clemson University, explained, "I was tasked with being prepress manager on this project. Once we got the files in, we needed to separate the front and back cover independently of each other. Given profile data, we managed color conversions from Photoshop with the Equinox plugin—once with the full expanded color ink set and once with the 4-color ink set."

He later said, "Color conversions affected the trap and the stayaways around the white text, when separated into 7-color on the front and



Siegwerk's Perry Stacks (L) studies the job with Black.



Station by Station, Color by Color: A seven station Ormet Varyflex was used to print the October cover. As inks—provided by Environmental Inks/Siegwerk Group—were laid down, the Halloween themed image came to life and the difference between the 7- and 4-color versions became more apparent.

4-color on the back. Building of traps is a bit easier in 7-color, because the stayaway lines are closer to the background color—for instance, green in a 7-color build versus yellow in a 4-color build.”

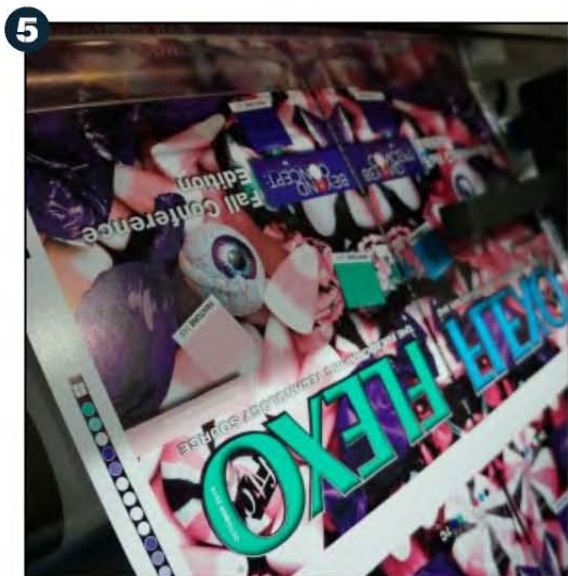
Mentioning one other consideration, he said, “We had three Pantone colors to match. Each of these was managed as a separate Pantone color and converted through the appropriate process. Separations were



engineered on the front cover to best match what 7-color can do and on the back cover to match the best they can to CMYK.”

PAPER & INK

Cover stock was supplied by Veritiv, the newly formed entity resulting from the merger of xpedx and Unisource. By name it is 100-lb. Endurance Gloss. According to Marketing Program Manager Scott Dickerson, it is known for its smooth surface that reduces mottling, excellent gloss holdout, strong brightness and opacity characteristics, as well as its excellent folding and highly dependable binding performance



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record. The cover stock is said to promote uniform color application, sharp imagery, crisp clarity and consistent runability.

Perry Stacks, technical service representative at Environmental Inks/Siegwerk Group, reported, "The ink system was actually developed a few years back, with Clemson University on 7-color process inks. We have since converted it to one of our newer lines—L39, UV flexo ink."

PRODUCTION RUN

A pressrun of some 25,000 copies run at 300 fpm on two separate days, the effort involved critical equipment from notable FTA mem-

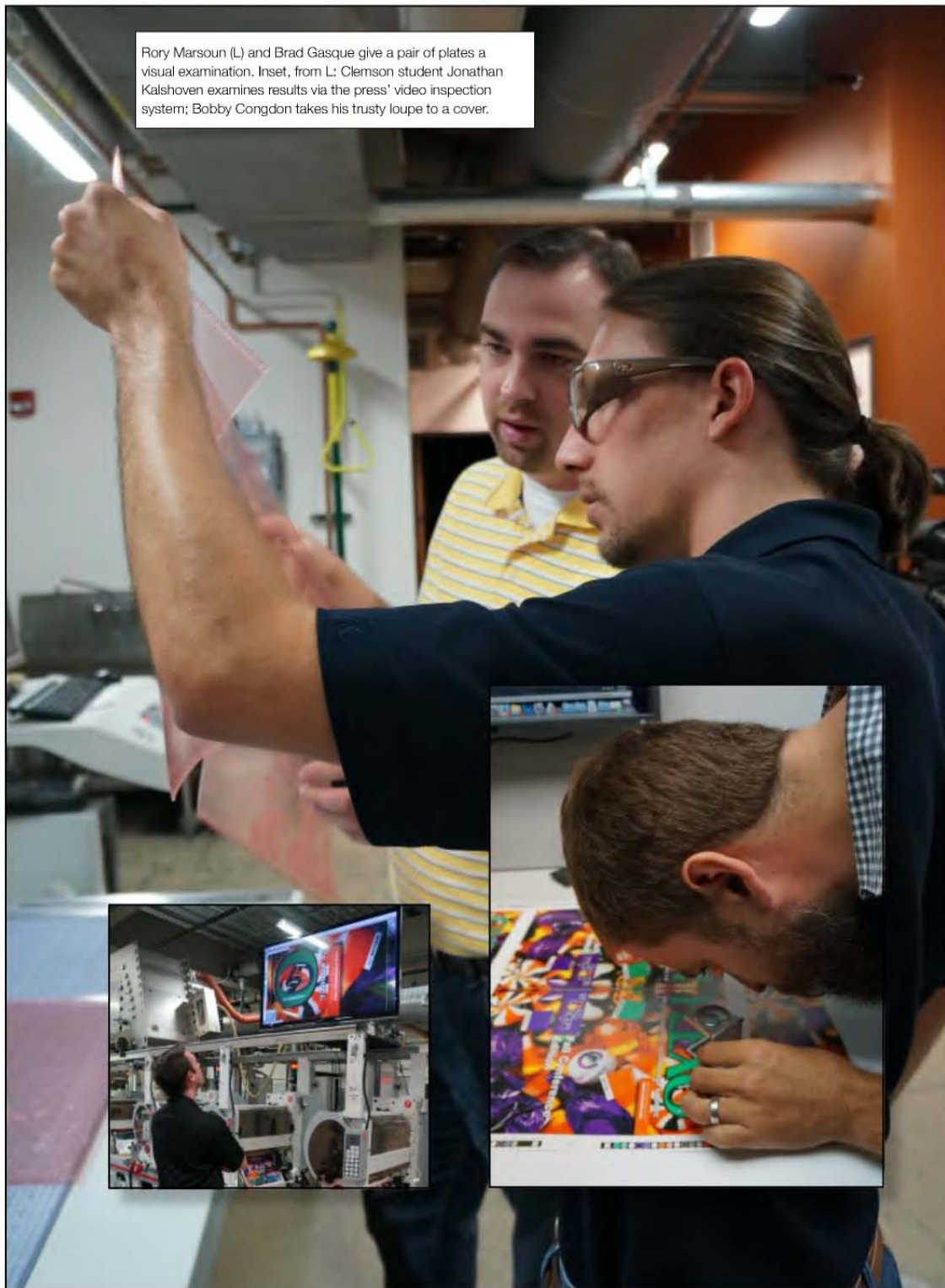
bers, beginning with the obvious Omet Varyflex inline combination press (seven station plus varnish). Web width was 18-in. *Flexographic Image Reproduction Specification & Tolerances (FIRST)* were strictly adhered to.

Also utilized in the effort: 3M mounting tape, ARC International resurfaced rubber rolls, Max Daetwyler Corp. doctor blades and ultra sonic cleaning tank, DIP pan liners, Erhardt+Leimer video inspection system and web cleaner, and Harper Corporation of America anilox rolls.

One team member remarked, "In essence, we set up new production in three days, then started from ground zero in reproducing spot colors with 7-color expanded gamut."

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Rory Marsoun (L) and Brad Gasque give a pair of plates a visual examination. Inset, from L: Clemson student Jonathan Kalshoven examines results via the press' video inspection system; Bobby Congdon takes his trusty loupe to a cover.



INITIAL REACTIONS & REFLECTIONS

As copies came off press, reviews were immediate and satisfaction was universally expressed.

Black exclaimed, "Tremendous difference between the 4-color and the 7-color!" Samworth decreed, "This is exactly the result we wanted—a cover that looks equal or better than the high end offset printed covers to which it will be compared."

Stacks commented, "The ink is performing very well. We're seeing the expected results and also the proper compensation curves—provided by Esko. We are achieving some very nice looking results on press."

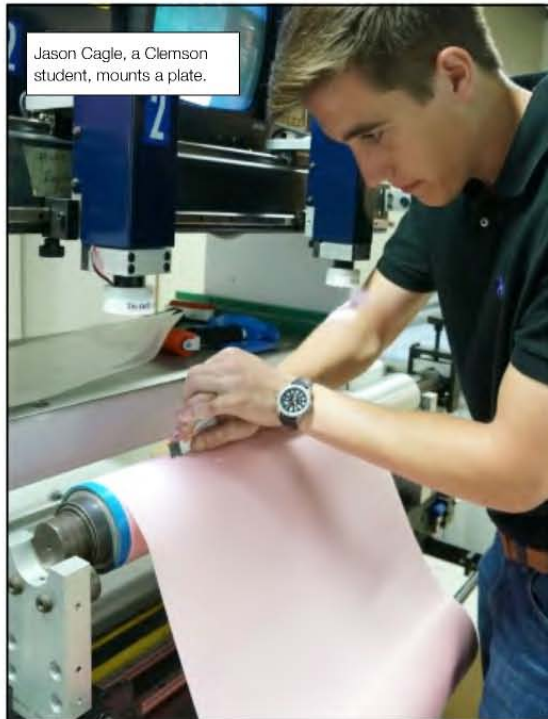
Tonkin said, "It's been a lot of fun. This project gave us an opportunity to really engage our industry partners. We brought together our technical team at Clemson, along with our best students, we stayed late and all worked together to pull it off."

Those students—six in all—appreciated the learning experience. Some weighed in with their thoughts. Senior Jonathan Kalshoven noted, "I learned a lot about color management, optimizing our color profiles and the color space that we'd be using for expanded gamut. We've noticed a lot of color difference between CMYK and just using a normal color gamut—process colors—and expanded gamut, using CMYK and then orange, green and violet."

Kariahlyn Lindsey, a senior, said, "I learned a lot about how critical it is for plates to be completely straight when doing expanded gamut. I also learned a lot about detail and flat top dots versus narrow top dots and overall quality printing with paper versus polymers, because we ran into the optical brightening agents affecting the print quality."

Scott Rickard, a second year graduate student, opined, "Overall, I was impressed by the opportunity that Clemson had to actually print the cover of the magazine using flexo. It shows a pretty direct comparison between 4-color and 7-color. These are pretty interesting results that the industry is really going to enjoy."

Brad Gasque, research associate at Sonoco Institute of Packaging Design & Graphics, Clemson University, oversaw production from start



Jason Cagle, a Clemson student, mounts a plate.

to finish, to include shipment of printed matter. Like Tonkin, all his associates, students and industry partners, he expressed pride in the results, following what he deemed a welcome challenge.

"When **FLEXO** magazine first contacted us to ask if we could print the cover for the October issue, we were honored to think they would choose us, especially working with the other companies involved. Being able to put all these technologies together from all these companies and print a magazine cover that not only looks as good as offset but really goes beyond and looks better—and doing it all flexo—is a great feat!

"It's been a good experience to go through this entire process, from optimization to fingerprinting the press to running the live job. It's been a challenge to take a 15-color job—seven colors and a varnish on the cover, six colors and a varnish on the inside—and print it on a seven station press with no turnbar, no reverse decks—so it's four passes," Gasque continued.

"A challenge is always welcome here at Clemson," he proclaimed. "That's really what we do is specialize in unique projects that would be more difficult in a production environment. We welcome the challenge and worked to meet it. As a result, we have a great magazine cover that the industry is going to be really impressed by when everyone realizes it's printed flexographically and not offset." ■

While at Clemson, the **FLEXO** team produced a video documenting the experience creating its October cover. To watch the video, visit www.flexography.org at the start of Fall Conference, Oct. 20.



Assessing early results: (L-R) Rory Marsoun, Courtney Norris, Mark Samworth and Chip Tonkin examine a print sample.