Stay connected!
Join the twitter conversation!
Use the hashtag #COLOR20
Welcome!

COLOR20 is finally here. What a year it has been! I can honestly say that planning this conference is one of the highlights of my year. The energy and enthusiasm of the people involved are infectious, as you will soon find out.

This year, we have more than 50 great sessions lined up for you presented by the leading experts in our industry. What makes this conference special is that you’ll not only get to hear them speak, you’ll get to know them as well. By the end of COLOR20, you’ll be a part of a unique community who understands the importance that color plays in our world. So without further ado, let’s get started!

Enjoy!!

Joe Marin, Vice President of Education & Training
Printing Industries of America

Download the Attendify app today in the App Store or on Google Play.
get the answers here
#COLOR20

## Saturday, January 11

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>10:00 AM</td>
<td>Conference Registration Open</td>
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<tr>
<td>10:30 AM</td>
<td>Color Management Fundamentals, Portofino/Marseilles</td>
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<tr>
<td></td>
<td>Don Hutcheson, HatchColor, LLC</td>
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<tr>
<td>1:30 PM</td>
<td>Fine Art Reproduction: The Ultimate Color Challenge, Marbella/Las Palmas</td>
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<tr>
<td></td>
<td>Brian Lawler, California Polytechnic State University</td>
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<tr>
<td>10:00 AM</td>
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## Sunday, January 12

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>7:30 AM</td>
<td>Conference Registration Open</td>
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<tr>
<td>7:45 AM</td>
<td>Continental Breakfast—Expo Resource Center Open</td>
</tr>
<tr>
<td>8:15 AM</td>
<td>Welcome &amp; Introductions</td>
</tr>
<tr>
<td>8:30 AM</td>
<td>Colors of Life, Frans Lanting, Frans Lanting Studio</td>
</tr>
<tr>
<td>9:30 AM</td>
<td>Break—Expo Resource Center Open</td>
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<tr>
<td>10:00 AM</td>
<td>I Love a Color Management Mystery</td>
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<td>Patrick Herold, CHROMiX</td>
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<tr>
<td>10:30 AM</td>
<td>Right Brain vs. Left Brain: Bridging Creative Design and Print Execution</td>
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<td></td>
<td>Angela Stone, Purposeful Packaging Design and Erica Arten, Rods and Cones</td>
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<tr>
<td>1:00 PM</td>
<td>Lunch</td>
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<tr>
<td>1:00 PM</td>
<td>Print Quality Scoring Systems: Conformance vs. Quality</td>
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<td></td>
<td>Dan Uress, Colorware USA, Inc.</td>
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<tr>
<td>2:00 PM</td>
<td>How to Become the Color Management Champion</td>
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<td></td>
<td>Joe Bolokowicz, Abelson Taylor, Inc.</td>
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<tr>
<td>2:30 PM</td>
<td>Extended Gamut Digital Print Automation</td>
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<td></td>
<td>David Palmieri, CGS ORIS Americas</td>
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<tr>
<td>3:00 PM</td>
<td>The Unsung Hero of Color Management</td>
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<td>Robert McCurdy, GTI</td>
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<tr>
<td>3:30 PM</td>
<td>FreeFlow Core Equals: CMYK Plus, Minus the Hassle</td>
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<td></td>
<td>Eric Thibodeau, Xerox</td>
</tr>
<tr>
<td>4:00 PM</td>
<td>CMG Color Management Solutions &amp; Cool Tools</td>
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<td></td>
<td>Ben Starr, colormanagement.com</td>
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</table>

**Color Tools**

Get ideas for your business from industry experts and suppliers in 16 valuable, concise 20-minute sessions. Color Tools are where you’ll see the newest gear and latest technologies and techniques to help you up your color game!
### Sunday, January 12 (continued)

<table>
<thead>
<tr>
<th>Time</th>
<th>Main Stage</th>
<th>Print &amp; Production</th>
<th>Brand &amp; Design</th>
<th>Standards, Research, &amp; Case Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30–9:30 AM</td>
<td>Is Color Standardization More Difficult Than Milking a Duck? Let’s Ask the Milkmaid, Cecile van der Harten, Rijksmuseum</td>
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<tr>
<td>9:30–10:15 AM</td>
<td>Part Two: Are You for the Orange Team or the Red Team?, Dr. Erica Walker, Clemson University</td>
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<td>10:30–11:15 AM</td>
<td>Building a Brand Loyal Brand, Daryl Eifler, iXColor, Inc.</td>
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<tr>
<td>11:30 AM</td>
<td>Conference Adjourns</td>
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### Monday, January 13

<table>
<thead>
<tr>
<th>Time</th>
<th>Keynotes — Main Stage</th>
<th>Print &amp; Production</th>
<th>Brand &amp; Design</th>
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</tr>
</thead>
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<tr>
<td>7:30 AM–5:00 PM</td>
<td>Conference Registration Open</td>
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<tr>
<td>8:00–8:30 AM</td>
<td>Continental Breakfast—Expo Resource Center Open</td>
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<tr>
<td>8:30–9:30 AM</td>
<td>The Power of the Perfect Color, Scott Lucas, Chief Growth Officer, Sterling Brands</td>
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<tr>
<td>9:30–10:00 AM</td>
<td>Break—Expo Resource Center Open</td>
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<tr>
<td>10:00–11:00 AM</td>
<td>Process Control and G7®: A Match Made in Color Heaven, Mike Todryk, IWCO Direct</td>
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<tr>
<td>11:10 AM–12:10 PM</td>
<td>Pro Tips for Troubleshooting Color, John Scott Thurburn, Canon USA</td>
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<tr>
<td>12:10–1:10 PM</td>
<td>Lunch</td>
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<tr>
<td>2:20–3:20 PM</td>
<td>Pantone: The Inside Scoop, Jason Campbell, X-Rite Pantone Inc.</td>
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<tr>
<td>3:20–4:00 PM</td>
<td>Break—Expo Resource Center Open</td>
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<tr>
<td>4:00–5:00 PM</td>
<td>So You Want to Have a 2 Delta E Tolerance?Dave Hunter, Pilot Marketing</td>
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<tr>
<td>5:10–6:00 PM</td>
<td>Improving Printer-Brand Relations, James Hillman, Mossberg &amp; Company</td>
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<tr>
<td>6:00–7:00 PM</td>
<td>Reception—Expo Resource Center Open</td>
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### Tuesday, January 14

<table>
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The goal of color management is to obtain the best possible color match from creation to output, but the topic can be intimidating if you don’t know how all the pieces come together. The good news is that color management is based on simple principles that anyone can understand, regardless of their technical knowledge.

Don Hutcheson, color management pioneer and inventor of the G7® methodology, will present Color Management Fundamentals to clarify the basic principles and workflows of color management and help you set realistic expectations. This complete introduction will benefit the novice who wants to get up to speed quickly or anyone who wants a thorough refresher. Come out of this session armed with the knowledge to take full advantage of the sessions at COLOR20!

The art of reproducing art is probably the most challenging of color management processes. In this very special preconference session, Brian Lawler will show you—from start to finish—the intricacies of lighting, camera position, camera profiling, printer profiling, and points of control. Get real insights on managing customer expectations, special printing papers, viewing conditions, and making it all match. Learn all about the color gamut of original art, the color gamut of ICC color spaces, and how to put color management to work to produce the most accurate of all color—fine art reproduction.
**Colors of Life**
Frans Lanting, Acclaimed National Geographic Photographer, Frans Lanting Studio  
*Sunday, January 12 from 8:30 AM – 9:30 AM*

Drawing upon three decades of fieldwork in wild places from the Amazon to Antarctica, master photographer Frans Lanting will share how he interprets color in the natural world for his iconic imagery. Hailed as one of the great photographers of our time, Frans Lanting is frequently commissioned by *National Geographic* and appears in books, magazines, and exhibitions around the world.

**Improving Printer-Brand Relations**
James Hillman, President and CEO, Mossberg & Company  
*Sunday, January 12 from 5:10 PM – 6:00 PM*

Brand owners and printers both want the same thing—consistent color output no matter what the product, process, or technology. Achieving that can be a challenge and can be the cause of friction. Learn how brands can provide essential visual guides and tools to their print partners to ensure compliance in producing corporate brand colors across offset, digital, and wide-format. See practical examples and learn what printers can do to be successful in matching corporate brand colors and what valuable information both can provide.

**The Power of the Perfect Color**
Scott Lucas, Chief Growth Officer, Sterling Brands  
*Monday, January 13 from 8:30 AM – 9:30 AM*

While perfect reproduction of a brand's color is an exact and valuable science, what goes into determining the colors that define a brand? Scott Lucas, President and CEO of Sterling Brands, will explore the role of color in defining a brand, connecting with consumers, and delivering a consistent brand experience. Get inside information on the process that drives color selection, how and what a brand chooses to own, and how to leverage a color or color palette.

**“Hey Man, I Ordered a Burger!”**
Jason Troutman, Principle Brand Designer, 3M  
*Monday, January 13 from 5:10 PM – 6:00 PM*

Have you ever been in a restaurant, anticipating that first juicy bite of a burger you ordered, only to have a cold lifeless salad placed in front of you? Yeah, we’ve all been there. “Was it the waitstaff? Was it the cook? It couldn’t have been MY fault!” The experience was a total miss.

Maybe this all sounds like your last interaction with a designer or a printer. The relationship between designers and printers has long been a blur. The convergence of creativity and control plays out in the consumer market, on the shelf, every day. Unpack (from one designer’s perspective) the misunderstandings, disagreements, blame, and outright ignorance that exists between our professions.

**Is Color Standardization More Difficult Than Milking a Duck? Let’s Ask the Milkmaid**
Cecile van der Harten, Image Department Manager, Rijksmuseum  
*Tuesday, January 14 from 8:30 AM – 9:30 AM*

Color is emotion and emotion is not always the best guiding principle. The Milkmaid—Vermeer’s oil on canvas painting—is not the best example of “the milk of human kindness.” Her looks are deceiving—her yellow vest seems to be more yellow than it actually is while her skirt is a nightmare.

In museum imaging, major advancements have been made to capture digital files that are scientifically reliable while serving as a starting point for how these artifacts will be reproduced—from publications to commercial products. For the Rijksmuseum, standardization is key to accurately reproducing the finest of art for historic preservation and future use. Join Cecile van der Harten to find out where we are today and what challenges lie ahead after more than ten years of color management in museum imaging.

**Part Two: Are You for the Orange Team or the Red Team?**
Dr. Erica Walker, Assistant Professor, Clemson University  
Co presenter: Michelle Mayer, Computer Engineering Major, Clemson University  
*Tuesday, January 14 from 9:30 AM – 10:15 AM*

Clemson Orange is critical to university and athletic branding, but it often skewers toward red or yellow on the screens during sporting events. A myriad of technical and environmental factors make it difficult to control the output. Last year, Walker shared the initial findings of this study and like most research, answers tend to lead to more questions. At COLOR20, you’ll learn about the progress made during the past year, including the results of testing a traditional solution and the trials encountered developing a new one. Be a part of the fun and wear any orange clothing you have to this presentation!

**Building a Brand Loyal Brand**
Daryl Eifler, Founder/CEO, i4Color, Inc.  
*Tuesday, January 14 from 10:30 AM – 11:15 AM*

Creating long-term partnerships with big brands requires a mix of great communication, exceptional customer service, and the ability to insert business directly into a client’s workflow. Using this mix, the i4Color brand has built loyalty with their elite brand clientele. In this session, Join Daryl Eifler as he shares perspectives and insights on how he’s made i4Color the go-to image creation and premedia resource for some of the world’s most recognized brands.
I Love a Color Management Mystery
Patrick Herold, Manager of Tech Support, CHROMiX
John Scott Thorburn, Senior Color Analyst, Canon USA
Sunday, January 12 from 10:00 AM – 11:00 AM

Join Patrick “Holmes” Herold and John “Watson” Thorburn as they explore some of their more baffling cases in this collection of real-life color management mysteries. Increase your color detective skills as they share how they solved color conundrums and identified malicious measurements and wicked workflows. Match wits with these famous color detectives and pick up several color sleuthing strategies while you’re at it!

Print Quality Scoring Systems: Conformance vs. Quality
Dan Uress, CEO, Colorware USA, Inc.
Sunday, January 12 from 1:10 PM – 2:10 PM

As print buyers become more familiar with quality scoring systems, new competition is emerging where printers are graded against themselves and the competition for the best print quality. Even if the work remains 100% in contractual compliance, there is no guarantee that the customer is 100% satisfied with print quality. Using practical examples, learn how brand owners and printers can manage these challenges and expectations from both sides.

Getting Color Right in Beverage Can Production
Rich Apollo, Anheuser-Busch InBev Color Quality Manager, Southern Graphics Systems (SGS)
Sunday, January 12 from 11:10 AM – 12:10 PM

Soda, beer, fizzy water—no matter what your favorite canned beverage may be—chances are you probably don’t know much about the process in which it was designed, manufactured, and distributed before reaching your hand. Join Rich Apollo as he discusses how beverage cans are produced and some of the color challenges of printing on metal.

So You Want to Have a 2 Delta E Tolerance?
David Hunter, President, Pilot Marketing Group
Sunday, January 12 from 4:00 PM – 5:00 PM

Which variables do you need to monitor and adjust for a 2-, 3-, or even 4-Delta E color tolerance? Backed by four years of scientific research, learn the differences, causes, and effects of color reference books, substrate variations, instrumentation, lighting, temperature, and more. Get practical takeaways to assess the influence of each of these variables within your production chain, understand how to manage them, and provide the tolerance your brand can accept.
You did it! High-five! You were able to eke out a G7® “shared appearance” across 13 different continuous web litho presses, two sheet-fed presses, 10 continuous web inkjet presses, 10 flexo presses, three Epson proofers, and three color toner devices. Now, if only you could count on it running that way tomorrow too. Mike Todryk will show you how G7®, standards, and process control can help maintain the “shared appearance” that has helped make IWCO Direct the leading direct mail marketing services provider in North America.

**Pro Tips for Troubleshooting Color**
John Scott Thorburn, Senior Color Analyst, Canon USA
Monday, January 13 from 11:10 AM – 12:10 PM

Modern digital output devices produce great color with little intervention—until they don’t. Identifying the problem, assessing where in color workflow it happened, and finding the solution are essential skills for all levels of digital color reproduction. Join us on a real-world journey through color space as we use common tools to identify, troubleshoot, and solve color-related problems.

**Best Practices of DeviceLink Technology**
Thorsten Braun, CTO, ColorLogic GmbH
Barbara Braun-Metz, CEO, CrossXColor, Inc.
Monday, January 13 from 1:10 PM – 2:10 PM

DeviceLink profiles allow for linking a specific input device with a specific output device to optimize color conversion. Learn how they can save ink, linearize output, simulate spot colors, create CMYK and multi-color separations, be incorporated with G7®, and much more!

**PANTONE®: The Inside Scoop**
Jason Campbell, Solution Architect, X-Rite Pantone Inc.
Monday, January 13 from 2:20 PM – 3:20 PM

Pantone® is a name ubiquitous in the world of color and design. “Hitting the color” can present significant challenges even with the latest advancements in color management and print technology. Join us as we discuss what Pantone® Guides are and more importantly, what they aren’t. Gain insight into how guides are made, why design apps differ, where the numbers come from, and how to manage expectations.

**Cx/X-4 and Its Use in Grand Format Printing**
Dan Reid, President, RPImaging, Inc.
Monday, January 13 from 4:00 PM – 5:00 PM

Matching spot colors requires a realistic definition of the reference or source color. Revisit the fundamentals of traditional spot color management and how CxF/X-4 resolves some of the problems found using the traditional method. We’ll also cover the tools needed to utilize CxF/X-4 data exchange in popular grand format RIP platforms.
Challenges between designers and printers can sometimes turn in to an MMA cage match. “Surely the designer didn’t intend for that to be printed with the 15 Pantone® colors used to build it, right?” Printing is a left-brain process, while creative design is all right brain. Bridging what the designer is trying to achieve and how it works with the technical realities of what’s needed by printers is critical. This session provides a primer for developing clear “how-to” and “why” guidelines on designing for print and communicating effectively with your design/production partners.

Getting great color output starts with solid native application and PDF files. How do you deal with PDF files that have a mix of RGB and CMYK imagery? Which PDF settings are best? How do you get the right color output for the target device? With Adobe Creative Cloud being one of the most prolifically used platforms in the industry, attend this session to learn how to get all your unruly native files and PDFs under color control!

Have you always relied on your printer to deal with color management? Are you a brand owner ready to build your own color-managed workflow and don’t know where to start? Become your company’s color management champion! This session will provide you with the key information required to get started in your company’s workflow to improve quality, increase efficiency, reduce cost, and get more color control.

How do you translate a great package design into a prototype? There are many tools available that make color accurate prototyping quick and easy to bring in-house. Get the lowdown on overcoming these production challenges and more with real-world experience and advice from end users who have implemented prototyping solutions.
No color family comes as loaded with cultural beliefs, preconceptions, and historical pseudo-science as skin tones. We’ll examine skin values numerically—and visually—to measure and determine what numbers in various color spaces make pleasing, printable skin tones. Let’s look at the numbers, swatch values, and photographs together, and uncover what we all have in common!
Analog Color Management in the 21st Century
Julia Kartush, Textile Designer and Color Analyst, Arden Companies
Sunday, January 12 from 10:00 AM – 11:00 AM
In a world full of spectral data, it’s easy to forget that the end consumer chooses a product mainly with their eyes—not with instrumentation. When regular use of a spectrophotometer isn’t in the cards, how do you communicate consistently and efficiently to get the results you want? Explore the benefits of proper visual assessment using a well-calibrated light booth and a proficient color analyst.

The New World of Backlit Media and Color Management
Ray Cheydleur, Portfolio Manager, Printing, Packaging and Imaging, X-Rite Pantone Inc.
Sunday, January 12 from 11:10 AM – 12:10 PM
The materials used for backlit displays are changing—it’s not just backlit signs using fluorescent tubes and inkjet-printed vinyl media. New substrate and backlight technologies require new measurement tools and new color workflows—this session covers the most up-to-date information in this fast-growing market!

Expanded Gamut Shoot-Out: Real Systems, Real Results
Dr. Abhay Sharma, Professor, Ryerson University
Sunday, January 12 from 1:10 PM – 2:10 PM
Get the latest research results of expanded gamut printing with CMYK+OGV software. How do systems reproduce the whole PANTONE+ Solid Coated digital library? Using HP Indigo and Epson expanded gamut printing systems, see all of the practical printed test results. Is expanded gamut ready for prime time? Who can achieve <2.0 DE? Attend this session for real systems and real results!

I Never Met-A-Meric I Didn’t Like
John Seymour, Owner, John the Math Guy, LLC
Sunday, January 12 from 4:00 PM – 5:00 PM
Metamerism is the often overlooked consideration when utilizing expanded gamut as a cost effective replacement for spot color. Despite excellent color management, packaging produced with spot colors sitting on the shelf alongside one printed with a combination of CMYKOGV inks may match under some lighting but not under others, potentially affecting consumer behavior. Get the facts of expanded gamut, lighting, and metamerism.
Standards, Research, & Case Studies Track  Sorento Room

Real World iccMAX
Chris Bai, Senior Color Expert / Vice Chair of ICC Displays Working Group, BenQ Corporation
Monday, January 13 from 10:00 AM – 11:00 AM

After years of planning, researching, and restructuring, ICC has announced the latest specification—iccMAX. What are the exciting new features of iccMAX? How can you leverage iccMAX and integrate it into your workflow? What currently works, and what doesn’t? In this session, learn all about iccMAX and get practical examples of how it can be leveraged in your color workflow!

Smartphone Cameras:
How To Maximize Image Quality and Color Accuracy
Ford Lowcock
Monday, January 13 from 1:10 PM – 2:10 PM

Do you own a “real” digital camera or, like most, do you rely solely on your smartphone to capture a moment in time? Have you ever stopped to consider just how accurate the color is from your phone? Attend this session and learn how to take full advantage of the camera phone’s sensor for optimum image quality, editing, and color reproduction.

Rethinking the Packaging Workflow:
Golden Masters and Color Spaces
Mike Strickler, Principal, MSP Graphic Services
Jack Frank, Color Process Manager, WestRock
Monday, January 13 from 11:10 AM – 12:10 PM

No industry sector can benefit more from intelligent color-managed workflows than package printing, but color conversion of documents with multiple process and spot color elements can cause major headaches and delays. Learn how to dramatically reduce job prep and improve quality by employing “golden master” documents with original color spaces and spot colors in automated late-binding workflows. A case study will also be presented to show the benefits of streamlined preparation of folding carton jobs for extended-gamut printing.

Standards are Boring!
William Li, Color Products Manager, Kodak
Monday, January 13 from 2:20 PM – 3:20 PM

Talking about standards is a sure way to create space around yourself at a crowded party. If you’re trying to land high-value accounts or a print buyer wanting to find a great printer—often sight unseen—then standards are where it’s at. Join William Li for a practical session on what print standards you need to know about and a few things about how to get there. You may not come out at the end as the life of the party, but you’ll definitely speak standards!

The Color Literacy Project: Designing an Interdisciplinary Resource for 21st Century Color Education
Maggie Maggio, Owner, Smashing Color
Monday, January 13 from 4:00 PM – 5:00 PM

The study of color has been relegated primarily to art education, where the information is often oversimplified, inaccurate, and fossilized. Radically rethink basic color education by introducing it as a collaborative arts and science subject at the elementary school level in STEAM programs and at the professional level across art, science, and industry. This session will present the goals and objectives of the recently formed Joint Committee on Color Literacy of the Inter-Society Color Council (ISCC) and the International Color Association (AIC).
**Konica Minolta**
Konica Minolta Business Solutions U.S.A., Inc. is a leader in industrial and commercial printing and packaging solutions. With a comprehensive portfolio of production print offerings, it delivers the latest innovations in printing, applications, and expertise. Its All Covered IT Services division offers a range of IT strategy, support, and network security solutions across all verticals. Konica Minolta has been recognized as the #1 Brand for Customer Loyalty in the MFP Office Copier Market by Brand Keys for 10 consecutive years and is proud to be ranked on the Forbes 2017 America's Best Employers list. Konica Minolta, Inc. has been named to the Dow Jones Sustainability World Index for five years in a row. We partner with our customers to give shape to ideas and work to bring value to our society. For more information, please visit: www.CountOnKonicaMinolta.com and follow Konica Minolta on Facebook, YouTube, and Twitter.

**Xerox**
In the era of intelligent work, we’re not just thinking about the future, we’re making it. Xerox Corporation (NYSE: XRX) is a technology leader focused on the intersection of digital and physical. We use automation and next-generation personalization to redefine productivity, drive growth, and make the world more secure. Every day, our innovative technologies and intelligent work solutions—Powered by Xerox®—help people communicate and work better. Discover more at www.xerox.com and follow us on Twitter at @Xerox.

**IPW**
"Strength In Numbers"—Printers Profit Through Sourcing Excellence!
Formed in August of 1998, Independent Printers Worldwide (IPW) is a national procurement group specializing in superior vendor programs for independent printers. With over 255 members (169 commercial, 8 envelope, 8 packaging, 70 FLAG Label) throughout North America, IPW members sell over $3.5 billion annually in print and communications solutions. Core areas for IPW are strategic sourcing (paper programs, small packaging, & LTL Shipping, Ink, coatings, prepress suppliers & equipment, digital & wide-format solutions, service & equipment programs, label converters programs), superior supplier management, and spend analysis. These foundational strategies and proven 20-year success have created a “life-line” for independent printers under assault by industry consolidation and change.

**Kodak**
Kodak is a technology company focused on imaging. We provide—directly and through partnerships with other innovative companies—hardware, software, consumables, and services to customers in graphic arts, commercial print, publishing, packaging, electronic displays, entertainment and commercial films, and consumer products markets. With our world-class R&D capabilities, innovative solutions portfolio, and highly trusted brand, Kodak is helping customers around the globe to sustainably grow their own businesses and enjoy their lives. For additional information on Kodak, visit us at kodak.com, follow us on Twitter @KodakPrint and LinkedIn @KodakPrint, or like us on Facebook at Kodak.
Koenig & Bauer
Koenig & Bauer (U.S.) is located in Dallas, Texas and is a member of the Koenig & Bauer Group which was established 200 years ago in Würzburg, Germany. Koenig & Bauer’s claim, “We’re on it,” gets to the heart of Koenig & Bauer’s values and competencies for all target groups. The group’s product range is the broadest in the industry; its portfolio includes sheetfed offset presses in all format classes, postpress die cutting, folder gluers, inkjet presses and systems, flexographic presses, commercial and newspaper web presses, corrugated presses, and special presses for banknotes, securities, metal-decorating, glass, and plastic decorating. For more information visit, the company’s website at www.koenig-bauer.com.

CGS
CGS ORIS is a software solutions company that specializes in color management for the professional graphics arts market. With over 30 years of experience, CGS ORIS is a world leader in digital proofing, packaging design, and print production along with a team of knowledgeable experts that will enhance the way you see color. We offer the largest portfolio of software solutions to color manage every step from prepress to print production for all sectors of the industry. Our award-winning products provide cost savings and turnkey solutions that increase efficiency. For more information, please visit our website http://www.cgsusa.com/

ColorLogic GmbH
ColorLogic GmbH is an award-winning, global company committed to providing the most advanced software technology in color management. We stay ahead of the industry by continually innovating technology to solve the industry’s toughest color management challenges. A strong relationship with our partners and team create a winning solution for our customers worldwide.

CHROMiX
CHROMiX creates tools for understanding and solving color problems. ColorThink is the world’s #1 profile analysis and visualization software. Curve2, Curve3, and now Curve4 has evolved G7 beyond IDEALink Curve, the first ratified G7 calibration software. Maxwell services ProofWatch, Digital PressWatch, and MeasureWatch have pioneered and still define cloud-based color conformance.
**Color Management Group**
CMG distributes color management products and services through a worldwide network of consultants and specialized resellers. There are many great color management products available. With so many options, our people, who have real world experience working for agencies, brands, and printers, are our greatest assets and have the knowledge to determine which specific mix of products/services will create the ideal color management solution for your unique situation.

**drupa**
drupa, the No. 1 international trade fair for printing technologies, will be held from June 16–26, 2020 in Düsseldorf, Germany, attracting over 1,800 exhibitors and 260,000 visitors from around the world.

**GMG Americas**
GMG is a leading developer and global supplier of high-end color management software solutions. Our customers span a wide range of industries and application areas including advertising agencies, prepress houses, offset, flexo, packaging, digital, and large-format printers as well as gravure printers.

**CrossXColor**
CrossXColor, Inc. is the U.S. partner for ColorLogic GmbH, serving its customers in North and South America. ColorLogic GmbH is an award-winning, global company committed to providing the most advanced software technology in color management. We stay ahead of the industry by continually innovating technology to solve the industry's toughest color management challenges.

**Esko**
Esko is a global supplier of integrated hardware and software solutions for the printing, packaging, sign, and display markets, driving profitability through reduction of waste and time-to-market, all while increasing productivity. Esko solutions are used in color management, artwork creation, structural design, prepress, 3D visualization, palletization, workflow automation, and digital finishing.

**GTI**
GTI's Graphiclite products conform to the ISO 3664:2009 viewing standard. The product line includes desktop systems, stand-alone viewing stations, wall viewing systems, and soft proofing systems. All products are manufactured in Newburgh, NY. A spectroradiometric laboratory and 100% measurement and verification production process guarantees that precision is built into all viewing systems.
Heidelberg
At Heidelberg, our focus is no longer strictly equipment. We offer tailored solutions to fit our customers’ needs and increase their productivity. Our products, services, and consumables are designed to meet customer requirements and increase profitability. We’re more than just machines; we’re about improving your entire business.

JUST Normlicht
JUST Normlicht is a worldwide manufacturer of standardized and custom lighting systems for controlled color and visual assessment environments. From ISO compliant LED-based programmable viewing rooms to viewing walls, booths, desktops, and portable systems, the product line addresses virtually all industries. Together with subsidiary GL Optic, JUST specifies, delivers, and measures the right lighting environment.

Kolormondo
Kolormondo is a small Swedish startup, having four patents for its award-winning concept of presenting colour in a 3D globe. It is being used by global brands and leading universities all over the world, making it easy for everybody to understand the basics of colour.

Remote Director
Remote Director’s introduction as the world’s first certified monitor proofing system in 2003 has provided some of the world’s largest printers, publishers, and agencies a streamlined production with improved quality in their approval processes. Our latest release is now providing the same to brands for their label and packaging creators. Remote Director accurately proofs any number of colors and uses embedded CxF data or custom color libraries. Whether you’re a small boutique or a global brand, there’s a Remote Director solution that’s right for you and your production partners.

Rods and Cones
Rods and Cones provides top-quality workflow systems and technical services for advertising and graphic agencies, photo studios, prepress services agencies, print providers, and in-house creative groups. Our expertise ranges from color management to developing workflow solutions that include DAM and automation. Digital Publishing, our newest division, was introduced in 2013.

Screen
SCREEN is a leading manufacturer of production-class inkjet printing technology delivering striking color and quality for commercial, mail, and label applications.

X-Rite
X-Rite Pantone is the global leader in color science and technology. X-Rite Pantone’s expertise in inspiring, selecting, measuring, formulating, communicating, and matching color helps users get color right the first time and every time, which translates to better quality and reduced costs.
COLOR20 glossary of terms

Absolute colorimetric rendering intent—A rendering intent that preserves in-gamut colors and clips those that are out-of-gamut. This method preserves the white point, which may sound appealing, but may actually result in image color shifts.

Additive color process—A means of producing a color reproduction or image by combinations of blue, green, and red colored lights, typically via color television systems or computer monitors.

Additive primaries—Highly saturated red, green, and blue lights that, when mixed together in varying combinations and intensities, can produce any other color.

Adjacent color effect—The visual influence of a highly saturated color on a nearby color.

Amplitude-modulated (AM) screening—Method of halftone screening in which the number of dots per inch remains consistent, varying only the size of each dot in order to create the illusion of continuous tone.

Banding—in digital output, a defect in a gradient (color blend) in which the discrete steps (shades) of the gradient are visible; usually produced when the system or output device cannot generate enough gray or color levels to render a smooth gradient.

Black—1. The absence of all reflected light; the absence of color. 2. An ink that appears to absorb all wavelengths of light. It is used as one ink in the four-color printing process.

Black, three-color—The color that would be produced if solids of ideal magenta, cyan, and yellow process-color inks were overprinted. Since each process-color ink absorbs some of the two components of white light that it should completely transmit, overprinting solids of three typical printing inks usually results in a brown. Many color control bars include a three-color patch.

Black printer—1. The plate that prints black ink in four-color process printing. 2. The halftone film used to burn the plate that will print black ink or the printing screen used in process-color reproduction to print the color black and add detail to the print. The letter “K” is often used to designate this color. Alternative term: key plate.

Black-and-white (B/W, B&W)—Originals and printed material comprised only of black and white with tones of gray.

Carbon black—The pigment commonly used in black inks. An intensely dark, finely divided pigment obtained by burning natural gas or oil with a restricted air supply. The resulting black pigment consists mostly of elemental carbon, a small percentage of ash (mineral matter), and a somewhat higher percentage of volatile matter. Toners are usually combined with this pigment in the ink formulation to make the black ink more neutral.

Chroma—A term used in the Munsell system of color specification to indicate the extent to which the color is diluted by white light. The intensity or strength of a color. Its saturation, or degree of departure from black and white.

Chromatic aberration—The failure of a photographic lens to converge rays of different colors to the same focal point.

Chromatic adaptation—The process by which the visual mechanism adjusts in response to the overall color of the ambient radiant energy.

Chromaticity—A color specification indicated by dominant wavelength and purity.

Chromaticity diagram—A graphical representation of two of the three dimensions of color. It is used for plotting light sources rather than surface colors. Alternative term: CIE diagram.

CIE—Commission Internationale de l’Eclairage (the international Commission on Illumination), an international standards-setting organization for colorimetry and related optical radiation measurements.

CIE chromaticity coordinates—The ratios of each of the tristimulus values of a color to the sum of the tristimulus values. In CIE systems, they are designated by x, y, and z. Alternative terms: trichromatic coefficients; trilinear coordinates.

CIE L*a*b*—A color model based upon the standards developed by the Commission on Illumination, or in French, the Commission Internationale de l’Eclairage. Color is represented in three dimensions by “L” (the lightness component), “A”, (the red/green component), and “B”, (the yellow/blue component). The “L” stands for luminance and the “a” and “b” indicate the color’s position on a coordinate system.

CIE L*u*v* color space—The 1976 CIE color space transformation with the dimensions L*, u*, and v*, in which equal distances in the space represent approximately equal color differences.

CIE standard observer—A hypothetical observer whose color matching performance conforms to either the 1931 CIE color matching functions for a 2o field size, or to the 1964 CIE color matching functions for a 10o field size.

CIE tristimulus values—The sum of the three reference or matching stimuli required to match with the color stimulus considered in a given trichromatic system.

CIE XYZ—The original color model developed in 1935 by the Commission on Illumination, or in French, the Commission Internationale de l’Eclairage. The “X,” “Y,” and “Z” values describe color in close relationship to the color sensitivity of the human eye.

CIE XYZ color space—A color space defined in terms of the tristimulus values X, Y, Z.
**CIP4**—An acronym for the International Cooperation for the Integration of Processes in Prepress, Press and Postpress, an international organization whose purpose is to encourage computer-based integration—interoperability—of all processes involved in graphic arts production and to establish the necessary standards. CIP4 is the successor of CIP3, which started in 1995 as a joint initiative of vendors for the graphic arts industry.

**Closed loop**—A process in which all control functions have been automated, including sensing output errors and correcting the input to compensate for the error.

**Closed-loop color**—A system of color reproduction in which scanner (input) image settings are based on printer (output) characteristics, enabling color matching between those two devices.

**CMYK**—Abbreviation for cyan, magenta, yellow, and key (black), the four printing process colors or inks used to simulate full-color printing. The letters are occasionally rearranged to indicate a specific printing sequence.

**CMYK color mode**—A color model based upon the subtractive primaries cyan, magenta, and yellow, as well as black. New colors are formed by combining cyan, magenta, yellow, and black in varying reflectance intensities. Black is used to provide increased darkness.

**Color**—The visual sensation whose characteristics are affected by the wavelengths of the light that produces it. A paper appears colored when it selectively absorbs light of certain wavelengths and reflects light of other wavelengths to the observer. Color viewing is a highly subjective experience that varies from individual to individual. In the graphic arts industry, lighting standards and color charts help ensure the accuracy of color reproduction.

**Color, HiFi**—A special high-fidelity color reproduction process that uses cyan, magenta, yellow, and black plus additional special colors to expand the color gamut of printing. With HiFi color based on the Küppers model, seven basic colors are used: cyan, yellow, magenta, orange, green, violet, and black. Because seven colors are used, color separations are made using stochastic screening technology to prevent moiré, which would occur if conventional halftone screening technology was used.

**Color balance**—1. The correct combination of cyan, magenta, and yellow needed to reproduce a specific photograph without an unwanted color cast or color bias. 2. The specific combination of yellow, magenta, and cyan needed to produce a neutral gray in the color separation process. 3. The ability of a film to reproduce the colors in an original scene. Color films are balanced during manufacture to compensate for exposure to specific light sources.

**Color bar**—A device printed in a trim area of a press sheet to monitor printing variables such as trapping, ink density, dot gain, and print contrast. It usually consists of overprints of two- and three-color solids and tints; solid and tint blocks of cyan, magenta, yellow, and black; and additional aids such as resolution targets and dot gain scales.

**Color blindness**—1. A deficiency in vision that permits a person to see only two hues in the spectrum, usually yellow and blue. 2. Term sometimes used to describe an emulsion that is only sensitive to blue, violet, and ultraviolet light.

**Color cast**—A shift in all colors of an original toward a particular color, such as a yellowish cast or greenish cast.

**Color conversion**—1. Generally, the conversion of image data from the notation system of one device into that of another. Typically, transformation of red, green, and blue input image values into cyan, magenta, yellow, and black output image values. See also: lookup table, color management module. 2. Producing color transparency from a color reflection original so that a flexible copy of the original can be color-separated on a rotary-drum scanner. Color conversions are also made for other duplication purposes.

**Color correction**—1. A photographic, electronic, or manual procedure used to compensate for the deficiencies of the process inks and color separation. 2. Generically, any change in image characteristics; specifically, adjustment of primary colors to change the hue or saturation of a selected color. 3. Any color alteration requested by a customer.

**Color deck**—A printing couple installed on top of a newspaper printing unit.

**Color deficiency**—An inherited abnormality in which viewers cannot distinguish between various colors, red and green in particular. This condition is more prevalent in men of all races than in women of any race.

**Color density**—The opacity, purity, or brilliance of a color.

**Color difference**—The apparent distinction between two colors viewed under standard conditions.

**Color difference equation**—A mathematical expression that represents the perceived visual difference between pairs of colors.

**Color fidelity**—How well a printed piece matches the original.

**Color gamut**—The range colors that can be formed by all possible combinations of the colorants in a color reproduction system. See also: palette.

**Color hexagon**—A trilinear plotting system for printed ink films. Adapted for the printing industry by PIA/GATF, the method was originally developed by Eastman Kodak. A color is located by moving sequentially in three directions (at 120° angles) on the diagram by amounts corresponding to the red, green, and blue densities of the printed ink film. The diagram is generally used as a make-ready analysis chart, particularly for detecting changes from standard in the hue and saturation of solids and overprints.

**Color profile**—A mathematical equation used to transform from one color space to another color space in order to more accurately match output of devices. In digital printing, generally used to refer to a color profile, especially of a specific piece of equipment (monitor, printer, scanner, etc.) enabling users to correlate color consistently on various devices.
Color management module—Connects together profiles to produce color transformations through a common reference color space, known as a profile connection space, for any number of color production devices (scanners, monitors, output devices).

Color management—The use of software to automatically determine the color reproduction characteristics of scanners, monitors, and output devices, and then to automatically make the image settings necessary for optimal color reproduction. Color management attempts to simplify color reproduction by putting color expertise and science into software.

Color management system (CMS)—A set of computer programs or utilities used to ensure color calibration by accurately translating from one color space to another throughout the production process. A CMS ensures consistent color throughout the prepress and print processes by calibrating the color relationships among the scanners, monitors, printers, imagesetters, proofers, and other devices in the chain from input to output, usually creating a device profile for each device. Color management consists of three primary steps: 1. calibration of input devices, monitors, and output devices to known specifications, 2. characterization, which is a way of determining the color “profile” of a particular device, and 3. conversion, which performs the “color correction” function between color-imaging devices.

Color match—Condition resulting when no significant difference in hue, saturation, and lightness can be detected between two color samples viewed under standard illumination.

Color matching system—Systems designed to communicate color accurately among those involved in the design and printing process. Involves the use of a swatch book filled with colors and corresponding ratios of base inks used for mixing those inks to match swatch book colors.

Color model—A means of numerically describing colors within a system. There are several models commonly used in printing production including CIELab, RGB, and CMYK.

Color primaries, additive—The three basic colors, which, when properly selected and mixed, produce any hue. In the visual spectrum, the three primary colors are green, red, and blue. When combined, these colors form white light. In the printing process, the three primary (process) colors are yellow, magenta, and cyan.

Color rendering index—A measure of the degree to which a light source, especially a fluorescent light, under specified conditions, influences how the perceived colors of objects illuminated by the source conform to those of the same objects illuminated by a standard continuous source. The standard source is usually some aspect of daylight. Alternate term: color quality index.

Color reproduction guide—A printed image consisting of solid primary, secondary, tertiary, and four-color, and tint areas. Its primary purpose is as a guide for color correction of the optical characteristics of the printing inks and the color separation system. The guide should be produced under normal plant printing conditions.

Color retention—The ability of a color to resist fading or otherwise deteriorating after exposure to light. Alternative term: colorfast.

Color separation—Using red, green, and blue filters to divide the colors of a multicolored original into the three process colors and black. The four resulting film intermediates are used to prepare the yellow, magenta, cyan, and black printing plates. Color separation is most often accomplished with an electronic color scanner, but film-contacting and process-camera methods are also employed on occasion.

Color space—The three-dimensional area where three color attributes, such as hue, value, and chroma, can be depicted, calculated, and charted.

Color specification system—Charts or swatches of preprinted color patches of blended inks, each with a corresponding number, used to allow designers, printers, and customers to communicate color with more accuracy.

Color swatch—A small, printed solid used for color matching or measurement. It represents what an ink color might look like after it is printed.

Color temperature—The temperature in the Kelvin scale to which a theoretically perfect black body (a Planckian radiator) would have to be heated to produce a certain color radiation. 5000 K is the color temperature of the graphic arts viewing standard. The higher the color temperature, the bluer the light. See Kelvin.

Color variation—Changes that occur in the density of a color during printing as a result of deviations in the amount of ink accepted by paper or the amount of ink fed to the paper.

Color vision, abnormal—Defective color vision, which may take the form of protanopia (confusion of red and bluish green); protanomaly (a deficiency in the red response to certain color mixtures); deuteranopia (confusion of red and green); deuteranomaly (a deficiency in the green response to certain color mixtures); tritanopia (confusion of blue and yellow); and monochromatism (inability to discern different hue and saturation values). Alternative term: color blindness.
**Color vision, average**—A characteristic of an individual with normal color vision who has average color discrimination ability. Variations in color discrimination ability are related to age and fatigue level, and may be influenced by the retina's L:M cone ratio.

**Color vision, normal**—A characteristic of an individual who does not have an acquired or congenital color vision abnormality. A person with normal color vision may have excellent, average, or poor color discrimination ability.

**Colorant**—An ink, pigment, toner, or dye that modifies the natural color of a substrate.

**Colorimeter**—A three-color instrument for reading light reflected from a surface or transmitted by an object, relating reflectance or transmittance to a mathematical model of human vision. A colorimeter is used for calibration/characterization of monitors and characterization of printers.

**Colorimetry**—A branch of color science concerned with measuring and evaluating the colors of objects or images.

**Complementary colors**—Any two opposite (or contrasting) colors that produce white or gray when combined. In printing, complementary colors neutralize or accentuate each other, diminishing or enhancing the attention value of the print.

**Continuous inkjet (CIJ)**—A nonimpact printing technology in which a steady stream of ink is forced at high pressure through a small nozzle and dispersed as small droplets through a charging field. The stream of charged droplets then passes between high-voltage deflection plates. Because the plate voltage varies, only selectively charged droplets form the desired shape or pattern on the substrate. Excess droplets are diverted and recirculated.

**Continuous tone**—A photographic image or art (such as a wash drawing) that has not been screened. It has infinite tone gradations between the lightest highlights and the deepest shadows. All traditional photographs (prints and transparencies) are continuous-tone materials.

**Contrast**—The relationship or degree of tonal gradation between the lightest and darkest (highlight and shadow) areas in an original, reproduction, or negative. A high-contrast image shows a large difference between the light and dark shades.

**Cyan**—A blue-green color, complementary to red. Along with yellow and magenta, one of the three primary subtractive colors, or process colors used in the printing process. Cyan transmits blue and green light, while absorbing red. Incorrectly called “process blue.”

**Delta E**—A measure of overall color difference between two samples. The different is expressed in MacAdam, NBS, or other units. Normally written as DE or DE.

**Densitometer**—An electronic instrument used to measure optical density. Available in reflection or transmission versions.

**Dot gain**—The change in apparent size of a printing dot from the film or plate to the press sheet. Usually expressed as an additive percentage; for example, an increase in dot size from 50% to 70% is called a 20% gain. Dot gain has a physical component—the gain in the dot area—and an optical component—the darkening of the white paper around the dot caused by light scatter within the substrate.

**Dye inks**—Screen printing inks made by suspending dyes in specific vehicle formations using inert thickening agents. These inks are used in textile decoration. Alternative term: dye pastes.

**Dye pigments**—Dyes that are naturally insoluble in water and can be used directly as colorants without any chemical transformation.

**Dye sublimation**—A imaging process that utilizes a sublimable dye imprinted on a carrier sheet to transfer images to a receiving sheet by placing them in direct contact with each other.

**Dynamic range**—The capacity of an image capture device (e.g., digital camera or scanner) to detect and record discrete tones, from the lightest to the darkest, in an original.

**Electromagnetic energy**—A form of energy traveling in waves; variations include radio waves, gamma rays, x-rays, infrared, and visible light.

**Electromagnetic spectrum**—A continuous sequence of wavelengths of electromagnetic energy, ranging from very long radio waves to extremely short gamma rays.

**G7®**—A printing procedure used for visually accurate color reproduction by putting emphasis on matching grayscale colorimetric measurements between processes. G7 stands for grayscale plus seven colors: the subtractive colors typically used in printing (Cyan, Magenta, Yellow, and Black) and the additive colors (Red, Green, and Blue). G7® is a registered trademark of IDEAlliance.

**Gamma**—The ratio of the contrast range of all or part of the reproduction to the corresponding contrast range of the original. A gamma of 1.0 means that the reproduction has the same contrast range as the original.

**Gamma correction**—Compressing or expanding the ranges of dark or light shades in an image.

**Gamut**—Range of colors rendered or described by a given color model.

**Gloss**—The relative amount of incident light reflected from a surface. A high gloss is suggestive of a polished surface that has the effect of reducing first-surface reflections and increasing the density range and saturation of the image. Printing papers are often said to have varying degrees of specular gloss.

**GRACoL®**—An acronym for General Requirements for Applications in Commercial Offset Lithography. GRACoL® is not a set of printing specifications but rather a set of guidelines for the exchange of information and materials in the commercial offset market to prevent costly mistakes, rework, and missed deadlines and to help improve customer communications. GRACoL® is a registered trademark of IDEAlliance.
**Gray**—1. Any neutral color ranging between black and white. The tint or color formed by blending black and white in varying proportions. 2. When a surface reflects a comparative ratio of each light wavelength in the visible spectrum at a relatively low combined intensity the human eye perceives gray.

**Gray balance**—The values for the yellow, magenta, and cyan that are needed to produce a neutral gray when printed at a normal density. When gray balance is achieved, the separations are said to have correct color balance. Gray balance may be determined through the use of a gray balance chart. See also: color balance.

**Gray component replacement (GCR)**—In areas where yellow, cyan, and magenta overprint, the process of replacing all or a percentage of the least dominant process color, along with appropriate percentages of the other two colors to produce a gray, with an appropriate value of black. It is specified as percent GCR or as total ink coverage. Color variation on press is less serious when GCR is used. See also: undercolor removal.

**Gray levels**—A term used to describe the number of individual tones that make up a digital halftone image.

**Gray scale**—A reflection or transmission film strip showing neutral tones in a range of graduated steps. It is exposed alongside originals during photography and used to time development, determine color balance, or to measure density, range, tone reproduction, and print contrast. Gray scales can also be used to check focus and resolution. Alternative terms: gray wedge; neutral gray wedge; step tablet; step wedge.

**Gray scale, continuous**—A narrow continuous-tone black-and-white image on film in which the density gradually increases from zero (the transparent film base). Alternative terms: gray scale; step tablet; wedge.

**Graying component**—The primary color least present in a trichromatic color; it determines that color's value.

**Grayness**—The amount of unwanted gray that appears to reflect from a process color ink film (yellow, magenta, cyan). In the Preucil Ink Evaluation System, the lowest of the three (red, green, and blue) densities expressed as a percentage of the highest.

**Halftone**—A printed reproduction of a continuous-tone image composed of dots that vary in frequency (number per square inch), size, or density, thereby producing tonal gradations. The term is also applied to the process and plates used to produce this image.

**Halftone screen**—A sheet of glass or film that is used as an intermediate between continuous-tone copy and photosensitive material. Continuous-tone images are exposed to the photosensitive material through the screen’s regular arrangement of transparent and opaque areas. This produces an image pattern of small, solid dots (or narrow lines) that vary in size (or width) and represent tonal gradations. Halftone screens with higher screen rulings (e.g., 133 lines/in. as opposed to 65 lines/in.) produce higher resolution images.

**Highlight**—The lightest or whitest area of an original or reproduction, represented by the densest portion of a continuous-tone negative and by the smallest dot formation on a halftone and printing plate.

**Highlight dots**—The very small black dots on a halftone film positive, or the very small clear dots in the film negative of the corresponding areas.

**Hue**—The primary and most basic attribute of a color that makes it distinct from another color, determined by its dominant wavelength of light on the visible spectrum. The name of a color, such as red, yellow, or blue. In ink manufacturing and color matching, hue is more commonly known as shade.

**Hue error**—1. A measure of the hue deviation from a theoretically perfect subtractive process (primary) color. Hue error is usually expressed as a percentage. 2. In the Preucil Ink Evaluation System, the largest unwanted absorption of a process ink, expressed as a percentage of the wanted absorption, both after subtracting the lowest unwanted absorption.

**Hue, primary**—1. Any three hues, normally a red, a green, and a blue, so selected from the spectral scale as to enable a person with normal color vision to match any other hue by the additive mixture in varying proportions. Alternative terms: physical primary hues/colors; physical color primaries. 2. In the subtractive color process, the primary hues are yellow, magenta, and cyan; those transparent inks/colors that absorb only (or mostly) the additive primaries of blue, green, and red, respectively.

**ICC (International Color Consortium)**—A group of companies in agreement that develop standards defining color and reproduction characteristics of hardware/software devices and media independent of device-specific characteristics.

**ICCMAX**—A next-generation color management architecture with significantly expanded functionality and a choice of colorimetric, spectral, or material connection space.

**ICC profiles**—A set of data that characterizes a color input device, output device, or color space, according to ICC standards. Profiles describe the color attributes by defining a mapping between the device source or target color space and a profile connection space, either CIELAB ($L^*a^*b^*$) or CIEXYZ. Every device that captures or displays color can have its own profile. The ICC standard provides for profiles in RGB format for scanners, digital cameras, and monitors; in CMYK format for printers and proofers; and in multi-color format for multi-color printing processes.

**Illuminant**. An illuminant is a mathematical representation of a theoretical real light source, used for calculating tristimulus values from a spectrophotometric measurement. The numbers represent relative power of the theoretical source at each point in the visible spectrum. The relative power distribution of a real source could be used for calculation, but real sources are difficult to standardize.

**Illuminant A**—Mathematical representation of tungsten halogen (incandescent). Color temperature: 2556K. Uses include metamerism testing. Simulates typical home or store accent lighting.
**Illuminant C**—Mathematical representation of filtered tungsten halogen (daylight). Color temperature: 6770K. Uses include metamerism testing. Simulates the CIE average daylight.

**Illuminant CWF-2 (F2)**—Mathematical representation of commercial, wide band fluorescent used in the USA (Cool White Fluorescent). Color temperature: 4150K. Uses include metamerism testing. Simulates typical office or store lighting in the USA.

**Illuminant D50**—Mathematical representation of noon sky daylight. Color temperature: 5000K. Uses include general evaluation of color, metamerism testing, and evaluating color uniformity and quality in the graphic arts industry.

**Illuminant D55**—Mathematical representation of noon sky daylight. Color temperature: 5500K. Uses include metamerism testing. Simulates the CIE average noon sky daylight.

**Illuminant D65**—Mathematical representation of average north sky daylight. Color temperature: 6500K. Uses include general evaluation of color, metamerism testing, providing visual correlation with spectrophotometric instrumental readings, and conformance with European and Japanese standards. Simulates average north sky daylight.

**Illuminant DLF-7**—Mathematical representation of commercial, wide band fluorescent used in the USA (Deluxe). Color temperature: 6500K. Uses include metamerism testing.

**Illuminant NBF-11**—Mathematical representation of commercial, narrow band fluorescent used in the USA. Color temperature: 4000K. Uses include metamerism testing. USA equivalent to TL84.

**Illuminant SPL (D65)**—Mathematical representation of GretagMacbeth-patented Filtered Tungsten Halogen as found in SpectraLight (Daylight). Color temperature: 6500K. Uses include critical evaluation of color, metamerism testing, providing visual correlation with spectrophotometric instrumental readings, conformance with European and Japanese standards, and agreement with the current Automotive standard. Simulates average north sky daylight.

**Illuminant SPL (D75)**—Mathematical representation of GretagMacbeth-patented, Filtered Tungsten Halogen as found in SpectraLight (Daylight). Color temperature: 7500K. Uses include critical evaluation of color, metamerism testing, and visual evaluation of opaque materials as outlined by ASTM D1729. Simulates north sky daylight.

**Illuminant SPL (HOR)**—Mathematical representation of Tungsten Halogen as found in SpectraLight (Horizon). Color temperature: 2300K. Uses include metamerism testing. Simulates early morning sunrise or late afternoon sunset.

**Illuminant TL83**—Mathematical representation of commercial, rare earth phosphor, narrow band fluorescent used in Europe and the Pacific Rim. Color temperature: 3000K. Uses include metamerism testing. Simulates typical office or store lighting in Europe and the Pacific Rim.

**Illuminant TL84**—Mathematical representation of commercial, rare earth phosphor, narrow band fluorescent used in Europe and the Pacific Rim. Color temperature: 4100K. Uses include metamerism testing. Simulates typical office or store lighting in Europe and the Pacific Rim.

**Illuminant TL85**—Mathematical representation of commercial, rare earth phosphor, narrow band fluorescent used in Europe and the Pacific Rim. Color temperature: 5000K. Uses include metamerism testing. Simulates typical office or store lighting in Europe and the Pacific Rim.

**Illuminant U30**—Mathematical representation of commercial, rare earth phosphor, narrow band fluorescent. Color temperature: 3000K. Uses include metamerism testing. Simulates typical store lighting for Sears. USA equivalent of TL83.

**Ink holdout**—The extent to which paper resists or retards the penetration of the freshly printed ink film.

**Ink transparency**—The degree to which light passes through an ink film without being absorbed or appreciably scattered.

**Inkjet printing**—A nonimpact printing process in which a stream of electrostatically charged microscopic ink droplets are projected onto a substrate at a high velocity from a pressurized system. The electrically controlled flow of droplets is either intermittent or continuous.

**Input profile**—Describes the color attributes of a particular input device, such as a digital camera or scanner, to enable accurate color conversions to an output device.
International Color Consortium (ICC)—A committee formed in 1993 that establishes and coordinates uniform, internationally accepted standards.

International Standards Organization (ISO)—An organization that establishes and coordinates uniform, internationally accepted standards.

IT8—Standard test targets for color characterization of different devices and media such as scanners and printers established by the Committee IT8 of the American National Standards Institute (ANSI).

Job Definition Format (JDF)—An industry standard designed to simplify information exchange between different applications and systems in and around the graphic arts industry. It enables the integration of commercial and planning applications into the technical workflow.

Kelvin temperature scale—A scale developed by the physicist Sir William Thomson (better known as Lord Kelvin) to measure absolute temperature; 0 on the scale being equivalent to absolute zero (−273.15°C); used to convert Celsius readings to the absolute scale. Viewing conditions in the graphic arts are measured in Kelvin.

Light—Electromagnetic energy with wavelengths (about 380 to 750 nm) that affect vision.

Light spectrum—The electromagnetic wavelengths (about 380 to 750 nm) that are visible to the human eye. Each color in the light spectrum has a different wavelength.

Lightness. Perception by which white tones are distinguished from gray or black, and light from dark color tones.

Magenta—The subtractive primary color that should reflect blue and red and absorb green light. It is one of the four process-color inks used in the printing process. Alternative term: process red.

Metamerism—The process where a change in illuminant will cause visual shift in a metameric color for a given observer.

Optical brightener—A colorless dye that absorbs ultraviolet radiation and emits it as visible radiation. The visual brightness of paper is increased by using an optical brightener.

Overprint—1. A color made by printing any two of the process inks (yellow, magenta, and cyan) on top of one another to form red, green, and blue secondary colors. 2. Solid or tint quality control image elements that are printed over or on the top of previously printed colors. Overprint patches are used to measure trapping, saturation, and overprint color densities. Like other quality control elements, overprints may be measured from a color bar in the trim of a press sheet or from the printed image itself.

Overprint colors—A color made by overprinting any two of the primary yellow, magenta, and cyan process inks to form red, green, or blue secondary colors.

Output profile—Describes the color attributes of a particular output device, such as a monitor, projector or printer, to enable accurate color conversions from an input device.

PANTONE®—A company best known for its Pantone Matching System (PMS), a proprietary color space used in a variety of industries, including printing and paint, fabric and plastic manufacturing. The Pantone Color Matching System is a standardized color reproduction system, allowing different manufacturers in different locations to refer to name and communicate over 3000 distinct colors.

PANTONE System—A color specification system used by designers and printers to communicate color. Available in Coated, Uncoated, and Matte, each swatch book contains a series of colors that can be referenced based on the assigned PANTONE notation.

Paper, coated—Wood pulp or rag-based printing paper with a layer of white clay or pigments and a suitable binder applied to its surface. This coating improves surface uniformity, light reflectance, and ink holdout. Generally, coated paper is most often used in high-quality, four-color printing. The finishes of coated papers range from the super high gloss of cast-coated enamels to the “glossless” look of matte-coated papers. Alternative term: enamel paper.

Paper, dull finish—Coated, or enamel, paper that is supercalendered to low gloss level.

Paper, matte finish—A coated paper without appreciable gloss. These papers combine some of the advantages of both uncoated and coated dull papers.

Paper, uncoated—Paper that has not been treated or processed with a surface coating. The rougher surface absorbs inks more readily.

Print contrast—The ratio of the difference in the density of a 75% (three-quarter) tone and a solid print to the density of the saturated solids on the press sheet. This densitometric measurement indicates how well the three-quarter tone to shadow areas of an image are reproducing on press.

Print contrast ratio—An ink film thickness-related indicator of dot gain in darker tonal regions. Lower values indicate greater tonal fill-in or gain.

Process color—The use of cyan, magenta, yellow, and black halftone images to create full-color printed images.

Process control—Identifying, measuring, and controlling variables in the printing and binding process in order to produce a high-quality product. Examples of variables include ink density, image registration, product trim size, and glue thickness on binding. Once a variable is measured, production personnel can track and benchmark quality numerically.
Reflectance—The ratio light reflected from a given tone area vs. light reflected from a white area.

Reflectance factor—in densitometry, ratio of the light intensity reflected by a target area to the light intensity reflected by a perfect reflector.

Reflection—An optical term for the direction change of a ray of light when it falls on a surface and is thrown back into the medium from which it approached.

Reflection, diffuse—Optical condition that occurs when parallel incident rays are reflected at various angles from a rough surface.

Reflection, specular—Optical condition that occurs when a smooth surface reflects parallel incident rays at a constant angle and these rays remain parallel in the reflected light.

Relative colorimetric rendering intent—A rendering intent that maintains a near exact relationship between in-gamut colors, while out-of-gamut colors are clipped to the nearest reproducible hue. The color data lost using relative colorimetric rendering is irreversible.

Rendering intent—When the gamut of source color space exceeds that of the destination, saturated colors are liable to become clipped (inaccurately represented), or more formally burned. The color management module can deal with this problem in several ways. The ICC specification includes four different rendering intents: absolute colorimetric, relative colorimetric, perceptual, and saturation.

Rich black—An enhanced, deep black consisting of 100% black and tints of one or more of the process colors. One rich black might consist of 100% black, 50% cyan, 40% magenta, and 40% yellow. Another might be 100% black and 30% cyan. Alternative term: super black.

Saturation rendering intent—A rendering intent that tries to preserve saturated colors, and is most useful when trying to retain color purity in computer graphics when converting into a larger color space. If the original RGB device contained pure (fully saturated) colors, then saturation intent ensures that those colors will remain saturated in the new color space, even if this causes the colors to become relatively more extreme.

Shadow—The darkest portion(s) of a print or an original. In halftones, shadows have the largest dots.

SPC—Statistical process control; the use of statistical techniques such as control charts to analyze a process or its outputs so as to take appropriate action to achieve and maintain a state of statistical control and to improve the process capability.

Specification—I. The requirements to which a given product or service must conform to meet a given set of needs. 2. A step on the path towards formal standardization, but can be incomplete and is inherently subject to change and development. Conformance to a specification allows a degree of standardization in advance of the development and formal ratification of a standard; input in the specification development process by commercial organizations can help ensure the longevity of resources produced in conformance with these specifications.

Specifications for Newsprint Advertising Production (SNAP)—Originally called Specifications for Non-Heatset Advertising Printing, a set of standards for color separations and proofing developed for those printing with uncoated paper and newsprint stock in the United States.

Specifications for Web Offset Publications (SWOP®)—A set of standards for color separation films and color proofing developed for those involved in publications printing. The SWOP standards help magazine printers achieve accuracy when color separations from many different sources are printed on one sheet. (Registered trademark of IDEAlliance)

Spectral reflectance curve—A curve that measures the reflection of light from objects as a function of wavelength throughout the visible spectrum.

Spectral response range—The spectral band in which the response per unit of radiant power is more than 10% of the peak response.

Spectral response—The manner in which the eye responds to visible radiation. Often used to also describe how the light-sensitive component (film, PMT, CCD, or CMOS) in a color separation system responds to visible and invisible radiation.
COLOR20 glossary of terms

Spectrocolorimeter—A color measuring device that records radiation at fixed intervals (typically every 10 nm or 20 nm) across the visible spectrum and uses these values to compute selected colorimetric responses.

Spectrogram—A diagram showing the relative sensitivity of a photographic material to different colors of light.

Spectrophotometer—Instrument for reading reflectance or transmittance of light at specified increments throughout the visible spectrum; spectrophotometric data can be used to calculate densito-meteric and colorimetric variables.

Spectrophotometric curve—A graph showing the reflectance or transmittance of a sample as a function of wavelength.

Spectrophotometry—The science of measuring color by analyzing the reflection or transmission of samples at specified points across the electromagnetic spectrum. The spectrophotometric curve is the most precise means for specifying colors since metameric pairs can be distinguished.

Spectrum—The series of color bands formed when a ray of light is dispersed by refraction; the rainbow-like band of colors resulting when a ray of white light is passed through a prism. See also: prism; white light.

Spectrum, electromagnetic—The entire range of wavelengths or frequencies of electromagnetic radiation extending from gamma rays to the longest radio waves, including visible light.

Spectrum, visible—The range of wavelengths of the electromagnetic spectrum—from about 400–700 nanometers—that cause the sensation of vision. See also: prism; white light.

Specular highlight—The lightest highlight area that does not carry any detail, such as reflections from glass or polished metal. Normally, these areas are reproduced as unprinted white paper.

Spot color—In multicolor printing, a color that is added in an individually specifiable region of a printed sheet, used to highlight individual page elements, such as logos, headlines, line art, etc. Spot color is distinguished from process color in that spot color can be added simply by imaging a second negative and making a second plate without requiring the complexities of color separations. See also: process colors.

Spot color printing—The selective addition of a non-process color ink to a printing job.

Standard Observer (1931, 2 Degree Observer)—The 2 degree visual field observer is the standard observer recommended by the Commission International de l’Éclairage (CIE) in 1931. This is based on the results of a color matching experiment that used a 2 degree field of view.

Standard viewing conditions—A prescribed set of conditions under which the viewing of originals and reproductions are to take place, defining both the geometry of the illumination and the spectral power distribution of the illuminant.

Statistical process control (SPC)—Method of understanding and managing production processes by collecting numerical data about each step in the process and all materials used in the production sequence, including output. This data is then analyzed to locate causes of variations.

Status “T”—A card of carefully calibrated white, black, and color patches used to check the spectral (color) response of wide-band reflection densitometers.

Status E densitometry—Standardized densitometer spectral response for use in the European graphic arts industry. Uses the Wratten 47B blue filter in place of the wider-band Wratten 47 blue filter used in status T densitometers.

Status T densitometry—Standardized densitometer spectral response for use in the North American graphic arts industry. Uses wide-band filters that produce a similar response to the status G (graphic arts) traditional filters. See also: T-Ref TM.

Stochastic screening—A halftoning method that creates the illusion of tones by varying the number (frequency) of micro-sized dots (spots) in a small area. Unlike conventional halftoning, the spots are not positioned in a grid-like pattern. Instead, the placement of each spot is determined as a result of a complex algorithm that statistically evaluates and distributes spots under a fixed set of parameters. With first-order stochastic screening, only the number of dots in an area varies, but with second-order stochastic screening, both the number and size vary.

Subtractive color system—A means of producing a color reproduction or image with combinations of yellow, magenta, and cyan colorants, which serve as filters to “remove” colors from a white substrate.

Subtractive primaries—In color theory, the pigment colors cyan, magenta, and yellow, which when printed one on top another form the additive primaries red, green, and blue, and the gamut of attainable colors.

Tonal value increase—The arithmetic increase in halftone dot percentage from that displayed by an electronic imaging system to the actual printed value. A concept related to dot gain.

Tone—The degree of lightness or darkness in any given area of a print.

Tone, three-quarter—A tonal value that is approximately 75% of the total dot area.

Tone compression—The reduction in density (or tonal range) that occurs naturally in the printed reproduction of an original. It is possible to compensate for it, to improve the quality of the reproduction.

Tone reproduction curve—A graph depicting the relationship between the densities of the original and the corresponding densities on the printed reproduction.

Tone reproduction—A term that relates the density of every reproduced tone to the corresponding original density. This relationship is best described by the use of graphical techniques.
Total ink coverage (TIC)—The total buildup of ink on a given spot on the paper; i.e., the sum of the percentages of black, cyan, magenta, and yellow printing at that spot. Printing processes have limits on the maximum TIC, somewhere in the 250% to 300% range.

Trapping—1. Printing a wet ink over a previously printed dry or wet ink film. 2. Creating thin overlaps between adjoining colors to compensate for misregister in prepress and press operations. If the colors are not trapped, the misregister may result in small areas of unprinted paper where colors would normally abut.

Trapping, dry—1. The ability of a dry, printed ink film to accept another wet ink film over it. 2. Printing overprints, or one color on top of another, when the first color is already dry. Printing multicolor work on a single-color press is an example of dry trapping.

Trapping, wet—1. The ability of a wet, printed ink film to accept another wet ink film printed over it. 2. Printing overprints, or one color on top of another, when the first color is not dry. Printing multicolor work on a web press is an example of wet trapping.

Tristimulus colors—Three color stimuli which, when combined in appropriate proportions, will closely match any given reference color. In practice, red, green, and blue lights are used for this purpose. Their composition may range from monochromatic spectral lines to bands of wavelengths, each of which comprises about one-third of the visible spectrum.

Tristimulus values—Sets of three numbers used to designate the amounts of red, green, and blue light in an image.

Uncoated—A paper stock that has received no mineral applications.

Undercolor—in process printing, the yellow, magenta, and cyan present in dark, neutral tones.

Undercolor addition (UCA)—The inverse function of undercolor removal (UCR). Undercolor addition is applied in conjunction with gray component replacement (GCR) because 100% GCR does not produce a good saturated black in a print. This makes it necessary to add a controlled amount of “undercolor” to the GCR in the black areas. Electronic scanners compute UCA. See also: gray component replacement.

Undercolor removal (UCR)—A technique used to reduce proportionate yellow, magenta, and cyan (the “undercolors”) dot percentages in neutral tones and replacing them with increased amounts of black ink.

Varnish—1. A thin protective coating applied to a printed sheet to protect the image and improve appearance. 2. The major component of an ink vehicle, consisting of solvent plus a resin or drying oil.

Viewing conditions—A set of American National Standards Institute (ANSI) specifications that dictate the conditions under which originals (transparencies and reflection prints), proofs, and reproductions are viewed. For the graphic arts, the standard specifies a color temperature of 5000 K (a light level of approximately 200 footcandles), a color-rendering index of ninety, and, for viewing transparencies, a neutral gray surround. Large-format transparencies must be viewed with 2–4 in. of white surround and should never be viewed with a dark surround. It is also necessary to view the original or reproduction at an angle to reduce glare.

Yellow—The subtractive transparent primary color that should fully transmit red and green, and completely absorb blue light. One of the four process-color inks.
MEASUREMENT & ASSESSMENT PROCEDURES

CGATS.4-1993, Graphic Technology
Graphic Arts Reflection Densitometry Measurements—Terminology, Image Elements and Procedures

ISO 5-3:1995, Photography
Density measurements—Part 3: Spectral conditions

CGATS.5-1993, Graphic Technology
Spectral Measurement and Colorimetric Computation for Graphic Arts Images

ISO 13655:1996, Graphic Technology
Spectral measurement and colorimetric computation for graphic arts images (based upon CGATS.5)

ISO 13656:2000, Graphic Technology
Application of reflection densitometry and colorimetry to process control or evaluation of prints and proofs

ISO 14807:2001, Photography
Transmission and reflection densitometers—Method for determining performance

ISO 14881:2000, Graphic Technology
Process control—Optical, geometrical and metrological requirements for reflection densitometers for graphic arts use

ISO/DIS 15790, Graphic Technology and Photography
Reflection and transmission metrology—Certified reference materials—Documentation and procedures for use, including determination of combined standard uncertainty

ISO/WD 20462, Photography
Psychophysical experimental method to estimate image quality

AS/NZS 1580.601.3, Colour
Methods of Colour Measurement

AS/NZS 1580.601.4, Colour
Calculation of Colour Differences

AS/NZS 1580.601.5, Colour
Calculation of Small Colour Differences Using the CMC Equation

CIE 116-1995, Industrial Colour—Difference Evaluation

CHARACTERIZATION TARGETS & TEST IMAGES

IT8.7/1-1993, Graphic Technology
Color Transmission Target for Input Scanner Calibration

IT8.7/2-1993, Graphic Technology
Color Reflection Target for Input Scanner Calibration

IT8.7/3-1993, Graphic Technology
Input Data for Characterization of 4-Color Process Printing

ISO 12640, Graphic Technology
Prepress Digital Data Exchange
• ISO 12640:1997, Part 1, Standard Color Image Data (CMYK/SCID)
• ISO/CD 12640-2, Part 2, XYZ/sRGB encoded image data (XYZ/SCID)
• ISO/WD 12640-3, Part 3, CIELAB encoded image data (CIELAB/SCID)

ISO 12641:1997, Graphic Technology
Prepress digital data exchange—Colour targets for input scanner calibration (equals IT8.7/1 and IT8.7/2)

ISO TR 14672:2000, Graphic Technology
Statistics of the natural SCID images defined in ISO 12640
**VIEWING CONDITIONS**

**ISO 3664:2000, Viewing Conditions**
Graphic technology and photography

**ISO/DIS 12646, Graphic Technology**
Displays for colour proofing—Characteristics and viewing conditions

**ANSI PH2.30-1989, Graphic Arts and Photography**
Color Prints, Transparencies and Photomechanical Reproductions—Viewing Conditions


**BS 950, Specification for Artificial Daylight for the Assessment of Colour**
* Part 1, Illuminant for Colour Matching and Colour Appraisal
* Part 2, Viewing Conditions for the Graphic Arts Industry

**AS/NZS 1580.601-3**
Standards for Colour, Visual Comparison and Instrumental Measurement Materials Evaluation


**ISO 2846, Graphic Technology**
Colour and transparency of ink sets for four-colour printing
* ISO 2846-1:1997, Part 1, Sheet-fed and heat-set web offset lithographic printing
* ISO 2846-2:2000, Part 2, Coldset offset lithographic printing
* ISO/FDIS 2846-3, Part 3, Publication gravure printing
* ISO 2846-4:2000, Part 4, Screen printing
* ISO/CD 2846-5, Part 5, Flexographic printing

**ISO 2834:1999, Graphic Technology**
Test print preparation for offset and letterpress inks

**ISO 2835:1974, Prints and printing inks**
Assessment of light fastness

**ISO 5737:1983, Prints**
Preparation of standard prints for optical tests

**ISO 12040:1997, Graphic Technology**
Prints and printing inks—Assessment of light fastness using filtered xenon arc light

**ISO 1234:1996, Graphic Technology**
Determination of tack of paste inks and vehicles by a rotary tackmeter

**ISO 12644:1996, Graphic Technology**
Determination of rheological properties of paste inks by the falling rod viscometer

**PRINTED OUTPUT**

**CGATS.6-1995, Graphic Technology**
Specifications for Graphic Arts Printing—Type 1 (note: this is based on SWOP)

**ISO 12647, Graphic Technology**
Process Control for the Manufacture of Half-Tone Colour Separations, Proofs and Production Prints
* ISO 12647-1:1996, Part 1, Parameters and measurement methods
* ISO 12647-2:1996, Part 2, Offset lithographic processes
* ISO 12647-3:1998, Part 3, Coldset offset lithography and letterpress on newsprint
* ISO/WD 12647-4, Part 4, Publication gravure process
* ISO 12647-5:2001, Part 5, Screen printing
* ISO/WD 12647-6, Part 6, Flexographic printing
* ISO/WD 12647-7, Part 7, Processes using digital printing or reproductions made on various traditional printing processes from digital files

**ANSI CGATS TR001-1995, Graphic Technology**
Color Characterization Data for Type 1 Printing

**BSI 4666-1971 (amended 1986)**
Specification for Inks for Offset Three- or Four-Colour Printing
Doodles:

get the answers here
Doodles:

get the answers here
Doodles:

get the answers here
COMPLETE COLOR MANAGEMENT SOLUTIONS

For a free trial go to:
www.colorlogic.de
new color spaces
streamlined interface
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full instrument support
seek-peak @ Color20

fluid analytics
peer comparisons
advanced web interface
best measurement automation
feed-&-fly & RFID/QR scans
press-side diagnostics

latest G7 specs
new i1Pro3 & Ci64 support
Full G7 Calibration / Verification

see our ColorTools session and visit our booth @ Color20
COLOR IS OUR DNA

CGS ORIS
the source for all of your color management needs

- Color Managed Workflow Solutions
- 3D Texture & Image Capture Scanning Solutions
- Cloud Based Brand Color Management
- Extended Gamut Workflow & Profiling
- Color Accurate Mock-Ups & Proofing
- Proofing & Prototyping Media

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