McCann’s Work on Retinex Celebrated

In honor of John McCann, this year’s recipient of the Edwin H. Land Medal, we are reprinting here abstracts from a selected sequence of papers published by John McCann and colleagues during his years of investigation in Polaroid’s Vision Research Laboratory (1961-1996) and more recently as consultant in color imaging. The unifying themes are the effort to understand more about how the human eye processes color information and the application of these findings to optimum color rendition in a variety of circumstances.

Interaction of the Long-Wave Cones and the Rods to Produce Color Sensation, John J. McCann and Jeanne L. Benton, 1969.1

The duplicity theory states that cones produce photopic or color vision, whereas the rods produce scotopic or colorless night vision. This paper reports experimental findings which demonstrate the capacity of the rods to interact with the long-wave cones to produce color sensations. Radiances of 546 and 450 nm that excited only the rods, and radiances of 656 nm that excited only the long-wave cones were determined. When the rods and long-wave cones were selectively excited with the minimum radiance necessary to see form, the observers reported seeing a large variety of color sensations. These observers also reported the same variety of color sensations at greater radiances when the rods and long-wave cones were selectively excited. Color sensations produced by the excitation of rods and long-wave cones were identical, except for slight differences of brightness and sharpness, to the color sensations produced by 656 and 495 ± 5 nm light, when both were above cone threshold. Therefore, under the described conditions, the rods can be as much a part of the human color-producing system as the cones. All of the above results can be explained by Land’s retinex theory of color vision.

Lightness and Retinex Theory, Edwin H. Land and John J. McCann, 1971.2

Sensations of color show a strong correlation with reflectance, even though the amount of visible light reaching the eye depends on the product of the reflectance and illumination. The visual system must achieve this remarkable result by a scheme that does not measure flux. Such a scheme is described as the basis of retinex theory. This theory assumes that there are three independent cone systems, each starting with a set of receptors peaking, respectively, in the long-, middle-, and short-wavelength regions of the visible spectrum. Each system forms a separate image of the world in terms of lightness that shows a strong correlation with reflectance within its particular band of wavelengths. These images are not mixed, but rather are compared to generate color sensations. The problem then becomes how the lightness of areas in these separate images can be independent of flux. This article describes the mathematics of a lightness scheme that generates lightness numbers, the biologic correlate of reflectance, independent of the flux from objects.

Rod-Cone Interactions: Different Color Sensations from Identical Stimuli, John J. McCann, 1972.3

Different color sensations were generated by two areas in a complex scene, even though both areas sent to the eye the same 656-nanometer radiance that excited the long-wave cones and the same 546-nanometer radiance that excited only the rods.
Quantitative studies in Retinex theory: A comparison between theoretical predictions and observer responses to ‘Color Mondrian’ experiments, John J. McCann, Suzanne P. McKee and Tom Taylor, 1976. 4

Land’s Color Mondrian experiments showed that a single wavelength-radiance distribution falling on a point on the retina can generate nearly any color sensation. In Part I we repeated that experiment, quantifying the color sensations for each of the many Mondrian areas. In Part II we show that each area’s color sensation correlated with a triplet of reflectances measured with photodetectors having the same spectral sensitivities as the cone pigments in the eye. This result provides a description of what the visual system does, but it does not provide a mechanism for how the visual system can do it because the reflectance measurements required the use of a reflectance standard and unchanging illumination. In Part III we describe a model for color sensations that computes three reflectances from the wavelength-radiance distribution without reflectance or illumination standards; hence, it is able to predict the color sensations seen by the observer. The model is able to predict gray, red, yellow, green and blue sensations associated with areas that send identical wavelength-radiance distributions to the eye.

Visibility of gradients and low-spatial frequency sinusoids: Evidence for a distance constancy mechanism, John J. McCann, 1978. 5

A substantial number of variables affect the visibility of sinusoidal displays. The luminance, spatial frequency (cycles per degree), the number of cycles of sinusoid, and the extent of average-luminance areas adjacent to the sinusoid all affect the observer’s sensitivity to a particular experimental target. The experiments that quantify these multivariable relationships also show that changes in display size on the retina have a remarkably small effect on the visibility of a display. These experiments demonstrate a constancy for the visibility of objects despite changes in viewing distance that is reminiscent of other constancies studied by Gestalt psychologists.


Method and Apparatus of Lightness Imaging, Jon Frankle and John J. McCann, 1983. 7

This invention provides mechanisms that detect the large dynamic range of radiant intensities in the natural environment, that use novel strategies to calculate an approximation of visual properties of objects, and that represent a scene with an image having specific dynamic range that is optimal for film, television and printing.

Photographs and other images are made according to the foregoing mechanisms from lightness fields produced from multiple comparisons between information associated with different groups of segmental areas, and different groupings of areas. Comparisons advantageously are made in succession with an ordered sequence of the spatial parameter and employing results of prior comparisons. 86 Claims, 21 Drawing Figures.

Influence of intraocular scattered light on lightness-scaling experiments, W. Alan Stiehl, John J. McCann, and Robert L. Savoy, 1983. 8

Following Munsell’s bisection procedure [J. Opt. Soc. Am. 23, 394 (1933)] we established a nine-step gray scale in which each step is an equal increment in lightness. We calculated retinal illuminances after intraocular scatter by using the point-spread function of Vos et al. [Vision Res. 16, 215-219 (1976)] After this correction for intraocular scatter, we find a logarithmic relationship between retinal illuminance and achromatic lightness scales that are determined by the bisection method. Additional bisection experiments with a series of different backgrounds corroborated this result. We find that lightness depends linearly on the logarithm of scatter-corrected retinal illuminance with different slopes for backgrounds of different lightness. This study also highlights the importance of using scatter-corrected illuminance in any quantitative model of lightness.

The IS&T Reporter is published bimonthly by IS&T—The Society for Imaging Science and Technology. 9

Executive Editor Vivian Wahworth
Managing Editor Ashley Young
New Products Editor William M. Atkin
Standards Editor David McDowell

Articles in this newsletter do not necessarily constitute endorsement or the opinions of the editors or IS&T. Advertising and copy are subject to acceptance by the editors.

IS&T—The Society for Imaging Science and Technology is an international non-profit society whose goal is to keep members aware of the latest developments in photographic and other imaging fields through conferences, journals and other publications. We focus on imaging in all its aspects, with particular emphasis on silver halide, digital printing, electronic imaging, color science, photofinishing, image preservation, pre-press technologies and hybrid imaging systems. The Society presently has 2,500 members in 36 countries and 7 chapters.

We publish the Journal of Imaging Science & Technology and co-publish with SPIE the Journal of Electronic Imaging. We conduct 4 to 8 conferences per year on selected topics of imaging science and technology.

©2003 Society for Imaging Science and Technology. All rights reserved.

IS&T—The Society for Imaging Science and Technology, 7003 Kilworth Lane, Springfield, VA 22151 USA. 703-642-9090; Fax: 703-642-9094; E-Mail: info@imaging.org; Web page: http://www.imaging.org.

Inside This Issue

Standards .................. 5
Honors & Awards........... insert
New Products .............. 7
Other Meetings ............ 8

The ideal color photograph is one that captures what we see. This implies that photographic film should record human color sensations. Ordinary photography and video systems respond to the amount of light coming from the world in front of the camera. There is a large variety of scenes that have a greater range of light intensities than can be reproduced on a reflection print. Ideally, these scenes can be printed by:
1. capturing the data from the world,
2. calculating color sensations,
3. writing those color sensations on a print.

Method of and apparatus for transforming color image data on the basis of an isotropic and uniform colorimetric space, Munib Abdulwahab, James L. Burkhardt, and John J. McCann, 1989.

A color transform enables color-image information to be recorded, displayed and otherwise processed with exacting control of color relative to a selected display. Apparatus implementing the transform enables a single-exposure photographic print of image information produced in pre-press equipment to predict with accuracy an ink-on-paper print of that information. Color-image information is transformed with a technique that produces output information for each output color component or other parameter at each point in response to up to all input parameters at that point. The technique includes scaling, normalizing and linearizing steps, and may include selecting a uniform color space for mapping the color response of the object (film) medium with the color response of the reference (print) medium. The output information may include approximate transform values and finalizing values. The technique can be implemented for real-time conversion with look-up tables storing approximate transform values and storing interpolation factors, including gradient values, for computing finalizing values. 23 claims, 3 drawings.

High-resolution color photographic reproductions, John J. McCann, 1997.

This paper will describe a fine-art reproduction process that: captures painting information with high-resolution color photographs; scans the information into a 300 mega-byte digital file; performs a 3D color calibration in a dedicated hardware color-transform circuit; makes a master positive color transparency and makes a reproduction on Polaroid color print film. The master transparency can be used to expose a large number of images. This combines the efficiency of instant photography with the color fidelity of digital color transform.


James Clerk Maxwell demonstrated the first color photograph in a lecture to the Royal Society of Great Britain in 1861. He used the demonstration to illustrate Thomas Young’s idea that human vision uses three kinds of light sensors. This demonstration led to a great variety of color photographic systems using both additive and subtractive color. Today, we have image-capture devices that are photographic, video, still, and scanning. We have hardcopy printers that are electrophotographic, ink jet, thermal and holographic, as well as displays that use cathode ray tubes, liquid-crystal, and other light emission color devices. The major effort today is to get control of all these technologies so that the user can, without effort, move a color digital image from one technology to another without changing the appearance of the image. The strategy of choice is to use colorimetry to calibrate each device. If all prints and displays sent the same colorimetric values from every pixel, then the images, regardless of the display, would appear identical. The problem with matching prints and displays is that they have very different color gamuts. A more satisfactory solution is needed. In my view, the future emphasis of color research will be in models of human vision. The purpose of these models will shift from calculating color matches to calculating color sensations. All the technologies listed above work one pixel at a time. The response at every pixel is dependent on the input at that pixel, regardless of whether the imaging system is chemical, photonic, or electrical. Humans are different. The color they see at a pixel is controlled by that pixel and all the other pixels in the field of view. Human color vision uses a spatial calculation involving the whole image. Except for human vision, all other color systems have the same output from a single input. In other words, if an input pixel has a value of 128, and the image processing changes that value to 155, then all pixels with 128 in will have 155 out. Human vision is unique among color imaging systems because a single input value (128) will generate a range of output values (0 or 55, or 128, or 255), depending on the values of other pixels in the image. Despite the remarkable progress in our ability to control the placement of dyes and pigments on paper, we must now return to the study of Maxwell’s interest – color theory – for the next advancements in color systems. In the future, we will see more models that compute the color appearance from spatial information and write color sensations on media, rather than attempting to write the quanta catch of visual receptors.


This paper is an attempt to integrate a wide variety of psychophysical experiments into a computational model to calculate color appearance. Having described the fundamentals of such a model, we turn to applying this model to printing wide dynamic range, real-life scenes and finding the best reproduction of an image with limited printer gamut.


In complex scenes the same gray material appears the same indifferent places in the scene. In simple displays, grays vary in lightness with surround. By definition “contrast” is the name of the mechanism that makes grays look darker in a white surround than in a black surround. It is generally believed that the white surround stimulates inhibition of the center, making that gray look darker. The black surround does not generate inhibition and hence the gray appears lighter. Assimilation is the name of the mechanism with the opposite effect. Grays with adjacent white no longer look darker than the same gray with adjacent black. Examples are Benary’s Cross, White’s Effect, Checkboard and Dungeon Illusions. These effects have been used to suggest a top-down analysis of the scene, implying mechanisms based on the recognition of illumination, objects or junctions. Recent experiments demonstrate that...
Colorimetry is limited to image data from a single pixel. Measures of errors between an “original” and a “reproduction” are usually described as the distance between the two values of a pixel in a colorimetric three-dimensional space. Human color constancy uses spatial comparisons between different parts of the image. The relationships among neighboring pixels are far more important than the absolute differences between the colorimetric values of an original and its gamut limited reproduction. If all the pixels in an image have a reproduction error in the same direction (red, green, blue, lightness, hue, chroma), then our color constancy mechanism helps to make large colorimetric errors appear small. However, if all the errors are randomly distributed, then small colorimetric errors appear large. This paper will describe experiments using constant colorimetric and appearance errors to produce variable quality of reproduction. Further, it describes a technique of calculating the best appearance image using spatial comparisons. This calculation will be applied to a color-gamut problem. This approach minimizes the spatial errors introduced by limited color gamut and employs human color constancy mechanisms, so as to reduce the color appearance differences caused by limited color gamut.

Capturing a black cat in shade: the past and present of Retinex color appearance models, John J. McCann, 2002.  
As a part of the Symposium ‘Retinex at 40’, this paper recounts the research on capturing real-life scenes, calculating appearances and rendering sensations on film, and other limited dynamic-range media. It describes: the first patents, a hardware display used in Land’s Ives Medal Address in 1968, the first computer simulations using 20 by 24 pixel arrays, psychophysical experiments and computational models of color constancy and dynamic range compression and the Frankle-McCann computationally efficient Retinex image processing of 512 by 512 images. It will include several modifications of the approach including recent modifications and gamut-mapping applications. This paper emphasizes the need for parallel studies of psychophysical measurements of human vision and computational models of imaging systems.

Standards Update
David Q. McDowell, Editor

This issue of Standards Update will briefly review some of the standards activities in the world of color science that potentially impact our imaging world. I will immediately start with the caveat that this area is so diverse that I am sure that some areas will be missed or under-reported. Therefore, this is an invitation, to any who are involved in activities that are not reported, to contact me and provide input for a follow-up Standards Update.

The ICC

One area that is currently very visible is color management and the International Color Consortium (ICC). The ICC is continuing to work aggressively to help move color management and the International Color Consortium (ICC). The ICC is continuing to work aggressively to help move color management and the ICC profile towards practical implementations that are recognized and as ICC documents.

The ICC is working on a follow-up Standards Update. Input for a follow-up Standards Update is requested. To contact me and provide input for a follow-up Standards Update, send an email to David.McDowell@ISP.com. I am sure that some areas will be missed or under-reported. Therefore, this is an invitation, to any who are involved in activities that are not reported, to contact me and provide input for a follow-up Standards Update.

At the recent ICC meeting in Barcelona Spain, the relationship between the PDF/X International Standards and the ICC characterization data registry and ICC profiles was emphasized. Briefly, every PDF/X file (file format for graphic arts data exchange defined in ISO 15930-1, -2, or -3) must point to either a characterized printing condition listed in the ICC registry or contain an ICC profile that colorimetrically describes the intended printing condition. In this way the intended printed color of all PDF/X data is either directly or indirectly described using ICC tools. This is an excellent example of synergy between two different organizations as well as a major step forward for the printing industry.

Other areas, receiving attention at the ICC meeting, were the rewriting of the ICC Profile Specification in a form compatible with national and international standards procedures, color managed workflow descriptions and scenarios, and requirements that should be considered for a possible CMM specification. It should also be noted that the ICC and ISO TC130 (Graphic technology) have jointly developed and approved a letter of agreement that is presently with ISO Council for ratification. This agreement will allow the ICC and TC130 to jointly publish the ICC Profile Specification, and other ICC Specifications, both as ISO Standards and as ICC documents.

The main thrust of the workflow discussions has been to develop a general understanding of color managed workflows and how they can be applied in many different industry sectors. Such an understanding will help define and develop implementation strategies for both users and developers, but more importantly will help identify areas in which the current ICC architecture and specifications need modification or strengthening. These workflow discussions are in turn building on the work of TC42/JWG23 and CIE Div8.05, both of which will be discussed later.

The CMM is the generic name given to the computational engine that processes the image data based on instructions contained in the associated ICC profiles. All CMMs must properly use all ICC defined profile tags but may also use privately defined tags. Many of the baseline capabilities and requirements are defined as part of the profile specification, but there is a growing desire to more explicitly define a default set of CMM requirements to ensure interoperability.

CIE Division 8 (Image Technology)

The work of CIE Division 8 was summarized in the Nov/Dec issue. Briefly as a review, CIE Division 8 (Image Technology) was formed in 1998, at the urging of the imaging technical community, to enable the CIE to better address the needs of the imaging industry and specifically the emerging world of color management. It works in cooperation with other CIE Divisions, particularly Division 1, Vision and Colour, and Division 2, Measurement of Light and Radiation, to provide the imaging industry with the tools necessary to measure, manipulate, communicate, and interpret color.

CIE Division 8, Image Technology. Division 8 consists of seven Technical Committees (TCs) which are:

- TC8-01 Colour Appearance Modeling for Colour Management Applications
- TC8-02 Colour Difference Evaluation In Images
- TC8-03 Gamut Mapping
- TC8-04 Adaptation Under Mixed Illumination Conditions
- TC8-05 Communication of Colour Information
- TC8-06 Image Technology Vocabulary
- TC8-07 Multispectral imaging

Two of these TCs have reports out for Divisional ballot (the first step in the CIE approval process).

The TC 8-01 report is titled “A colour appearance model for colour management systems: CIECAM02”, and the TC 8-03 report is “Guidelines for the evaluation of gamut mapping algorithms”.

TC8-02, TC8-04, and TC8-05 all plan to prepare intermediate or final reports in 2003. TC8-06 is an ongoing effort in support of the larger CIE vocabulary project and TC8-07 is a new activity that was started late in 2002.

TC42 and TC130

Our traditional standards committee are also doing color related work. Much of this is occurring in Joint Working Groups (JWGs) between TC42 and TC130.

TC42/JWG 20 is developing the multi-part standard ISO 17321 which includes specifications and procedures for the color characterization of digital still cameras (DSC). The standard will include options for using either physical targets or spectral illumination techniques and will include recommended methods for determining transforms from raw DSC data to scene-referred image data.

The term “scene-referred” comes from Part 1 of ISO 22028, Photography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange, being developed by TC42/JWG23. Part 1 lays out the Architecture and requirements and introduces a very significant concept that is essential to many color imaging applications.

That concept is the idea of an “image state” and the recognition that there are scene image spaces and picture or output image spaces and that there is no simple transform between the two. This is further complicated by the fact that we often use the same color encoding for both.

A typical example is that if we had a digital still camera that exactly captured the colorimetry of every object in the scene we could not, and indeed would not want to, replicate the scene colorimetry in a print of the scene. Yet we often report and talk about the colorimetry of the reproduction and the original using similar metrology and data encoding. Again as color management systems incorporate digital still camera input,
and build transforms to typical output spaces, these concepts become critical to enable a common understanding of data between applications.

Although not directly a color issue, TC42/JWG21 is continuing to revise the ISO 5 series of densitometry standards. Of particular interest is the revision of ISO 5.3, *Photography and graphic technology - Density measurements - Part 3: Spectral conditions*. The current draft is based on the concept of spectral products which are essentially filter functions. The revised draft will be based on computations based on spectral data. While the numerical differences are small, the theoretical base and traceability issues are significantly different. Suffice it to say we will soon have clearly defined procedures to compute density from spectral measurements.

ISO 12646, *Graphic technology — Displays for colour proofing — Characteristics and viewing conditions*. The ability to match color images displayed on monitors (often called a soft proof) to the images produced when the same digital file is proofed and printed is increasingly expected in many applications. The appearance of a color image on a monitor is influenced by many physical factors in addition to viewing conditions. Among the most important of these are uniformity, convergence, size and resolution, freedom from flicker, the calibration of the display and the settings of its display driver software. Therefore, ISO 12646 also specifies minimum requirements for factors such as uniformity, convergence, refresh rate, size and spatial resolution.

TC130 has recently approved ISO 12640-2, *Graphic technology — Prepress digital data exchange — Part 2:XYZ/sRGB encoded standard colour image data (XYZ/SCID)* is in DIS (final approval) ballot. This standard defines a set of reference images that are constrained to fit within the sRGB color gamut. They compliment the popular CMYK/SCID image set of ISO 12640 (soon to be re-designated ISO 12640-1). However, to insure that the two image sets are not confused, different images were selected for the new image set. These should be available for widespread use shortly after the ballot closes in April 2003.

As part of the development of ISO 12640-3, a large gamut set of SCID images which is the third part of the SCID image sets, there was a need to define the gamut limit for expected colors. At the same time the ICC has been investigating the pros and cons of defining a gamut limit for the PCS to be used in gamut mapping applications. This has led to the possibility that together the ICC and TC130 can agree upon and standardize a reference gamut of real world reflection colors. This could provide a useful reference in many applications. It is too soon to tell if this is possible, but is an example of the synergy we are seeing between the various groups involved in color imaging standards.

**I3A**

I3A (International Imaging Industry Association) is the new name for the trade association that supports the Photographic Industry. It is the secretariat for ISO TC42 and for the ANSI standards committees responsible for photographic standards.

One of these committees, IT10, has approved three extended gamut color space standards for photographic data application. These are: I3A 7466, *Electronic Still Picture Imaging - Reference input medium metric RGB color encoding (RIMM-RGB)*; PIMA 7666, *Electronic Still Picture Imaging - Reference output medium metric RGB color encoding (ROMM-RGB)*; and PIMA 7667, *Electronic Still Picture Imaging - Extended sRGB color space - e-sRGB*.

As TC42, the TC42/TC130 JWG’s, and the ICC get more involved in extended gamut color spaces as work on data exchange spaces I am sure we will be hearing more about these color spaces.

**Summary**

The world of color science can be daunting. A lot is going on, much of which can have a direct impact on the imaging community. This has been a brief look at some of the more significant recent activities.

**Other Standards Items of Note**

**TC130 (Graphic technology)**

The DIS ballots on the revisions of PDF/X-1 and PDF/X-3, adding PDF 1.4 compatibility, as well as the DIS ballot on PDF/X-2 have all been approved. It is expected that these standards will be published within the next few months. In addition the DIS of the revision of ISO 12639 (TIFF/IT) has also been approved.

A new work item (NWI) ballot is being circulated in TC130 which proposes the development of an ISO standard which will define an XML based file format to enable the exchange of information about the color characteristics of reflection or transmission materials.

**TC42 (Photography)**

The DIS ballot of ISO 22028-1 (see above) has been approved and it is being prepared for publication.

**TC 171 (Document Management)**

A new joint activity has been initiated between NPES-The Association for Suppliers of Printing, Publishing and Converting Technologies, and the Association for Information and Image Management, International (AIIM International) to develop an International standard that defines the use of the Portable Document Format (PDF) for archiving and preserving documents.

The project, currently referred to as PDF/A, will address the growing need to electronically archive documents in a way that will ensure preservation of their contents over an extended period of time, and will further ensure that those documents will be able to be retrieved and rendered with a consistent and predictable result in the future.

This need exists in a growing number of international government and industry segments, including legal systems, libraries, newspapers, regulated industries, and others.

The intent is to create a Joint Working Group, under the auspices of ISO/TC171, that will include participation from at least ISO/TC171, ISO/TC130 (Graphic technology), ISO/TC46 (Information and Documentation), and ISO/TC42 (Photography).

This work is seen as a parallel effort to the PDF/X work in TC130, but addresses a different market need. It will draw upon both the knowledge gained in the PDF/X work as well as potentially parts of the PDF/X standards themselves. More information and contact data is available at www.aiim.org.

For suggestions for future updates, or standards questions in general, please contact the author at mcdowell@npes.org or mcdowell@kodak.com.
New Products

Edited by William M. Aitken

Here are the highlights from some recent press releases on both digital and film based cameras introduced at the PhotoMarketing International Convention and Trade Show 2003 in Las Vegas this past March.

TV Sharecam was announced by SoundVision/Armchair Electronics, Wayland, MA. Consisting of a point and shoot digital camera, TV docking station and wireless remote control, the product is aimed at easy TV viewing of digital images in the home without using a personal computer. Stored images can be edited, displayed as a thumbnail index sheet or as a full screen single image, rotated and saved on SecureDigital (SD)® memory cards in the docking station and using the remote control. MSRP is $149.95. More information: www.armchairelectronics.com and www.soundvisioninc.com.

At the recent PMA 2003, the reorganized Polaroid Corporation introduced new products including: a new Polaroid One Instant Camera for the consumer market, T690 Advanced Professional Color peel apart instant film, the Digital MiniPortrait all in one digital camera and thermal printing system for document photography, and a stand alone Polaroid Digital Printing Kiosk for instant digital printing using Polaroid’s new “Opal” instant imaging technology.

The Polaroid One Instant camera, an update of the classic OneStep camera, is 33% smaller and 23% lighter. MSRP is $49.95.

The Polaroid Digital MiniPortrait System is especially well suited for passport photography. A simplified user interface reduces training time for store personnel. It features 3x zoom, one push autofocus, adjustable integrated strobe, hand held or tripod mount options, a large viewing LCD screen, USB port and 80-90 second print time at 300 dpi using Polaroid thermal media film. MSRP is $1199.

Polaroid T690 Advanced Professional color peel apart instant film gives bright well saturated colors with flexible development times and consistent results. It is especially suited for proofing and passport photography. The film’s new chemistry offers greater processing temperature latitude—55°F to 105°F and greatly reduced sensitivity to development timing. Single and twin pack MSRP is $20.90 and $39.80 respectively.

The Polaroid Digital Instant Prints kiosk produces high quality 4x6 inch prints from digital camera memory cards at the rate of 2 seconds per print. The printer is based on Polaroid’s new “Opal” film technology (patents pending) which features a unique “frozen ink” technology. Originally introduced at Photokina2002, the current product reflects many improvements.

For more information on the above products: www.polaroid.com

In yet another effort to afford compatibility between digital cameras and printers from different manufacturers, the Camera and Imaging Product Association (CIPM) announced adoption of PictBridge. Originally proposed as “DPS” by Canon, Inc., Fuji PhotoFilm Co., HP, Olympus Optical Co., Seiko Epson Corp., and Sony Corp., the specification has been adopted by CIPA as CIPA DC-001-2003. Cameras and printers implementing PictBridge will allow direct printing and editing of stored camera images from any participating manufacturers cameras to any similarly equipped printer without using a personal computer. Advanced options will include “zoom” printing of a selected area of a displayed image, multiple copies of a single image, adding a date imprint and specifying print size. Contact: www.cipa.jp/pictbridge.

MyTopo.com now offers custom printed aerial photo maps based on USGS National Aerial Photography Program photographs. The source photography was taken from 1990 to the present and is generally more current than existing USGS topographic maps. The on-line site allows selection and previewing of the area of interest which is then merged into a virtually seamless custom photo map. A similar service is provided for custom topo maps. Maps measure 18”x24”, in glossy finish for display or on weatherproof media for field use for $14.95 plus shipping. Contact: www.mytopo.com.

The Fujifilm FinePix F700 is the first consumer 6.2 mp digital camera using Fuji’s new Super CCD SR technology. The SR sensor uses 3.1 million larger pixels with high light sensitivity and an additional 3.1 million smaller pixels with reduced light sensitivity resulting in high resolution and four times the dynamic range of previous Super CCD’s. The camera offers near film like image quality (2832x2128 pixels), and offers 3x optical and 2.2 digital zoom with a host of other features. MSRP is $599.95. More information: www.fujifilm.com/finepix or www.fujifilm.co.

JVC’s Digital Hi-Def Camcorder (GR-HD1) offers a way to shoot and edit real ATSC Standard HD content (with MPEGEdit Studio ® ProLE), record save that HD content (D-VHS with D.Theatre ™ HM-DH30000) and view on a variety of TV displays. The new camcorders record in both NTSC and US ATSC HDTV Standard video on a Mini-DV cassette. Recording can be in 4:3 480I (DV compression) as well as 16:9 480/60p and 720/60p (MPEG2 compression). With its analog component output, it plays back in 480I (NTSC), 480/60p or 720/60p and 1080I (ATSC) making it compatible with virtually all display devices. Its digital iLink outputs 480I (NTSC), 480/60p, 720/30p (ATSC) to D-VHS or computers via FireWire ®. Available in May 2003, MSRP is $3499.95. More information: www.jvc.com.

The Pentax Espio 140V - The sleek, low profile body houses a 38-140mm (3.7x) high quality zoom lens with Switchover Zoom System for effortless switching between wide and telephoto lens settings along with a host of other features. Contact: www.pentaxusa.com.

Olympus introduced the “Stylus Digital” camera, bringing the popular ultra compact all weather and easy to use features of the Stylus 35mm film cameras to the company’s growing digital lineup. MSRP for the Stylus 300 Digital Camera is $449, and for the Stylus 400 Digital Camera, $549. Contact: www.olympus america.com.

Canon USA offers new camcorders ZR70MC, ZR65MC and ZR60 at MSRP of $799, $699 and $599 respectively. The new cameras offer extraordinary optical zoom capabilities of 22x, 20x and 18x respectively. All models include Canon’s Image Stabilization technology and a 680kp CCD, Advanced Dual Image Signal Processing to maximize image quality for both video and still image recording. Contact: www.usa.canon.com, www.powershot.com.
May 18 - May 23, 2003  
SID’03: International Symposium, Seminar & Exhibition, Baltimore Convention Center, Baltimore, MD  
Sponsored by: SID: Society for Information Display  
Web: www.sid.org

July 8 - July 11, 2003  
Visual Communications and Image Processing (VCIP) 2003, University of Italian Switzerland (USI), Lugano, Switzerland  
Sponsored by: IS&T and SPIE: The International Society for Optical Engineering  
In cooperation with: IEEE Circuits and Systems Society and EURASIP: The European Association for Signal and Speech Processing  
Web: www.vcip2003.ch

August 3 - August 8, 2003  
Optical Science and Technology - International Symposium, San Diego Convention Center, San Diego, California  
Sponsored by: SPIE;  
Web: www.spie.org/info/am

August 4 - August 6, 2003  
AIC Color 2003 “Color Communication and Management” - Midterm Meeting, Bangkok, Thailand  
Sponsored by: International Color Association; E-mail: aran@sc.chula.ac.th

August 23 - August 26, 2003  
Particles 2003, Westin Prince Hotel, Toronto, Canada  
Web: nanoparticles.org/Particles2003/

August 23 - August 28, 2003  
Preserving Photographs in a Digital World Seminar, George Eastman House, Rochester, NY  
Sponsored by: George Eastman House, Rochester Institute of Technology and Image Permanence Institute, (585) 271-3361 ext. #420 or seminar@geh.org  
Web: www.rit.edu/IPI

September 7 - September 11, 2003  
ITCom 2003 - Information Technologies and Communications, Orange County Convention Center, Orlando, Florida  
Sponsored by: SPIE  
Web: www.spie.org/info/it/

RIT (Rochester Institute of Technology) offers an ongoing series of courses on graphic arts and imaging topics. Contact: Linda Keeney; 716-475-5852; Fax: 716-475-5571; E-mail: LMKTE@rit.edu; http://www.rit.edu.

For a more complete listing of imaging conferences, visit IS&T’s website: www.imaging.org