LD+A Lighting Design + Application • November 2005

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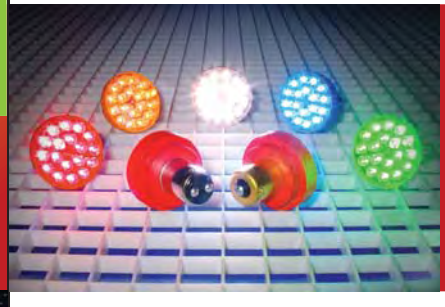
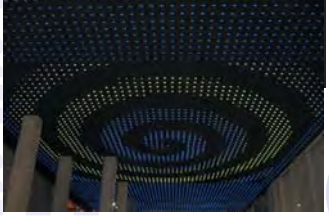
What's New What's Next

LEDs

LEDs





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LED APPLICATIONS

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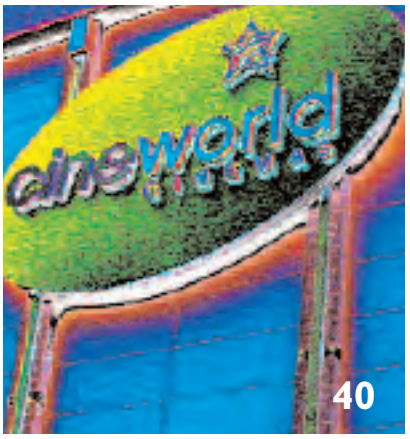

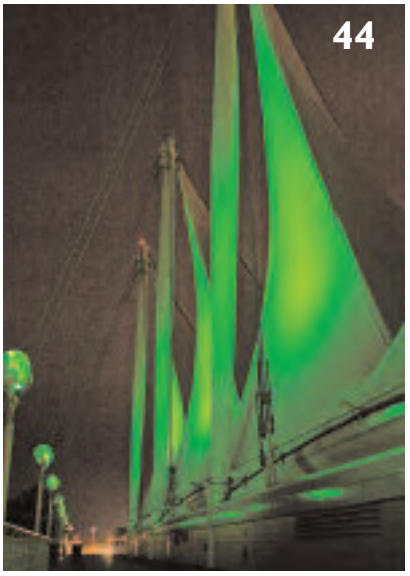

ON THE COVER:
Clockwise from top: Photo by Ronald Lo, courtesy of OptiLED; photo courtesy e3LED; photo courtesy LEDtronics; photo FAO Schwarz by J.P. Lira, courtesy Rockwell Group/Focus Lighting.

Paul Tarricone

IN 1988, THERE WAS NO Internet, reality TV was the evening news, Los Angeles had not one but two NFL teams, and "LED" was not part of the lighting lexicon. Things change. Today, Los Angeles is football-free on Sundays, but it's got plenty of LED fixtures—160 of which now adorn the city's longest suspension bridge.

You see, if a project hangs around long enough, a viable design solution might emerge. In 1988, San Pedro community activists had a dream—to light the Vincent Thomas Bridge (page 37)—but no money. By the late 1990s, they had the money, but no lighting approach that all stakeholders could agree on. Enter LEDs.

And with that, enter the first issue of *LD+A* themed to LED applications. I guess it's a sign that on the very day I began writing this editorial, staring at me from my MSNBC.com homepage was an article titled, "LED light bulbs: a bright idea?" The author, Gary Krakow, begins by asking, "Next time you screw in a cheap incandescent light bulb, ask yourself this: Do you ride a horse to work? Still churning your own butter?"

That might be overstating LEDs' current market penetration in architectural lighting applications, but there's little doubt that the trend lines continue to point in that direction. You couldn't navigate the aisles of LIGHTFAIR the past few years without stumbling across an LED manufacturer around every bend. (The number of LED manufacturers at the show doubled from 2003 to 2004, according to the "2004 LED Specifier Report," published by Zing Communications.) Meanwhile, the recently enacted federal Energy Act allocates millions to LED R&D, and the Department of Energy is currently partnering with the Next Generation Lighting Industry Alliance to support commercialization of solid state lighting.

Out in the field, the applications are moving well past narrow niches—"pen lights and Christmas lighting" as Krakow calls them—to more sweeping, general illumination installations. The projects are more high-profile too. A supermarket freezer is one thing; a landmark bridge in one of the nation's largest cities is another.

LEDs may also be on the cusp of achieving a certain gravitas within the industry. What makes the Vincent Thomas bridge project so intriguing is that the LED solution satisfied more than just the architainment or decorative needs of the bridge. There were many players with different agendas who had a seat at the table when LEDs were selected in L.A., and LEDs appear ready to seize a more prominent seat at the table when lighting choices are made.

A supermarket freezer is one thing; a landmark bridge in one of the nation's largest cities is another

Paul Tarricone

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LD+A is a magazine for professionals involved in the art, science, study, manufacture, teaching, and implementation of lighting. *LD+A* is designed to enhance and improve the practice of lighting. Every issue of *LD+A* includes feature articles on design projects, technical articles on the science of illumination, new product developments, industry trends, news of the Illuminating Engineering Society of North America, and vital information about the illuminating profession.

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Inertia Means No Respect

You are so right about lighting not "getting any respect." (LD+A, *October*, Editor's Note.) Sometimes, though, it might be a few lighting designers' own fault because they suffer from terminal inertia in changing procedure and have not yet adopted alternate lighting tools available abroad for decades. With the great emphasis on lighting in energy conservation, perhaps federal and state governments offering rebates and reduced taxes might change attitudes.

During my four-year service as an appointed member of the national ASRAE/IESNA Committee on Standard 90.1, I could not convince the group to include fiber optic functional architectural lighting in the models. Even our local IESNA section hasn't had a seminar on fiber optics since February 2002!

Soon glass fiber optics should join fluorescents and halogens to expand the designer's palette. This would eliminate some designers' complaints that the energy conservation mandates hinder planning. It is possible, within the restrictions, to create sophisticated yet sustainable illumination using every suitable method and a little imagination. However, in all cases, energy conservation must be balanced with increased productivity. Otherwise, it is useless.

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THE SOVEREIGN CITY OF New York has had its own electrical code for over 100 years (thanks to Thomas Edison's choice of business location), but we decided to adopt the National Electric Code (NEC) of 1999, with amendments, because of the complexity of an electric network that serves largely high-rise office buildings and apartment houses with 138,000 V running under some of our streets. And we adopted an amended 2002 NEC and are working on the 2005 NEC adoption as we speak.

The Energy Code we must follow is the New York State Energy Conservation Construction Code of 2003, which is based on the International Energy Conservation Code (IECC), with amendments. Some of us who practice in NYC felt that with all the tourists who stay in hotels and visit the theater, museums, shops, etc., we required some subjective changes to that code, which gave credit for controls instead of strict LPD (Lighting Power Density) limits, and still respect the intent of the code.

New Proposals

Several of us, including Charles Stone II of Fisher Marantz Stone, president of the IALD, and Paul Gregory, founder of Focus Lighting, addressed the Technical Committee of the N.Y. State Department of State with suggestions as to how to amend the code and still accomplish energy conservation. With help from the committee, especially its chair, Steve Rocklin, assistant director of energy services, Division of Code Enforcement and Administration, several amendments to the N.Y. State Code were proposed.

- *101.6.2 Renewable Energy*. The provisions of this code shall not be applicable to building systems, which are demonstrated to derive energy solely from renewable sources.
- *102.4 Electrical Energy Consumption*. In all buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

  Ed. Note. Many apartment houses in NYC have master meters and consumption is estimated based upon the size of the apartment, not based on actual usage.
- *ECC-20 Section 805.4* : "Internally illuminated exit signs shall not exceed five watts per side."
- *ECC-22 Table 805.5.2, Footnote "c"*: "Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting, and is switched or dimmed on circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or 1.6 watts per sq. ft times the area of the specific display, or 3.9 watts per sq. ft times the actual case or shelf area for *displaying and selling merchandise including, but not limited to jewelry, apparel and accessories, or china and silver*, shall be added to the interior lighting power determined in accordance with this line item."

  Reason: This proposal deletes an undefined, subjective term that may be interpreted in wildly diverging ways. By retaining the examples, it offers direction to designers and enforcers.
- *ECC- 24 Sect. 805.5.2.3 Interior Lighting Power Increase*: Interior lighting power calculated in accordance with Sections 805.5.2.1 or 805.5.2.2 may be increased by up to 50 percent of quantifiable energy savings from automatic lighting controls not required by Sections 805.2.1 through 805.2.2.2.1 provided these controls meet the acceptance requirements in the *Advanced Buildings E- Benchmark* Version 1.0 Appendix A.

  Reason: This change provides additional flexibility for lighting designers to use innovative approaches to lighting controls to reduce energy consumption, while gaining the ability to add accent lighting or other specialty lighting to selected spaces.

> The energy codes can be amended without having to fight city hall

Progress In The Process

In May of this year three forums were held throughout the state to advise the public of the changes proposed to our energy code. In September the Code Council of the New York State Uniform Fire Prevention and Building Code approved the proposals and passed them on for public comment. Hopefully, these amendments will be adopted and incorporated in the energy code

In September 2005, New York City adopted a "Green Building" law for city owned and financed structures requiring that they meet LEED standards, though not necessarily official LEED certification.

Any one of the states, cities, towns, etc., that adopt national energy codes like ASHRAE/IESNA 90.1 or the IECC can amend them to suit local conditions and, if desired, give credit for the use of lighting controls, as long as they meet the intent of the code.

NYC residents are not alone in having little patience for "process," but look at what progress the proponents of light trespass laws and dark skies legislation have made. The energy codes can be amended without having to fight city hall. Eric Richman of the Pacific Northwest National Laboratory is chair of the Lighting Sub-committee of the ASHRAE/IESNA 90.1 Committee and he encourages members of our Society "to get involved in the code formulating process because it makes for a better standard."

I urge you to get involved in the local, state or national code writing process. You will be helping our industry and may wind up saving your own job.

Willard L. Warren, PE, LC, FIESNA, is the principal of Willard L. Warren Associates, a consulting firm serving industry, government and utility clients in lighting and energy conservation.

John D. Bullough, Lighting Research Center, Rensselaer Polytechnic Institute

TWO THINGS ANNOY ME about the start-up of some lighting systems. One is the delay that can occur between pressing the "on" switch and actually seeing light. Another is the slow warm-up times of some systems, where the system starts out with relatively low light output and takes time to reach the right amount. I guess I just don't like to wait for my lighting. Most people, including me, are probably used to the lighting at home (mostly incandescent) where the lights generally turn on at full brightness apparently as soon as we flip the switch.

It is sometimes technology such as programmed starting and certain discharge lamps, which have increased life and energy efficiency, and which can result in the start-up delays and longer warm-up times I dislike. But if others also find these aspects annoying, it could be a barrier to more widespread use of more efficient lighting technology.[1] Indeed, in the U.S., for example, the federal Energy Star specifications[2] for screwbase compact fluorescent lamps require them to start within one second and to reach 80 percent of their full light output within three minutes.

What Do We Know?

There's not much information in the literature about how people might respond to delays and low light levels at start-up. I haven't yet found any literature on responses to delayed starting except that some instant start equipment could result in shorter (and less bothersome) delays compared to some programmed start equipment. In the May 2004 installment of "Research Matters," Yukio Akashi described several studies of the noticeability of slow light level changes, such as dimming in order to reduce electrical load during peak demand times.[3] Akashi mentions that these studies generally found that most people did not notice a 20 percent change in light level, when that change occurred over at least several seconds. Since some lighting systems have start-up and warm-up times of up to a few minutes,[4] the difference between the initial and final light output could sometimes exceed 20 percent and, therefore, be quite noticeable.

Overall then, there is little information in the literature about how these factors might affect people's perceptions of and responses to the start-up performance of lighting systems. We do know that people can notice, and will disapprove of, lighting that starts and warms up slowly.[5] As part of a project to identify suitable performance metrics for energy efficient lighting, we conducted a very simple pilot study to explore this issue.

Pilot Test

In a small laboratory, we set up a table lamp (**Figure 1**) on a workbench and asked subjects to enter the room (which was dark), turn on the light and complete a short questionnaire. The table lamp contained a low-voltage incandescent lamp that could be easily controlled, and that when illuminated at full output, produced about 75 footcandles on the workbench. We divided the subjects randomly into three groups of 10. For each group, the lighting behaved differently when switched on:

- For the first group, the lamp turned on nearly immediately (within about a quarter of a second) to full output (control condition).
- For the second group, the lamp turned on after a 1.5-second length of time (delay condition).
- For the third group, the lamp turned on nearly immediately to half output and then increased to full output over 10 seconds (ramp-up condition).

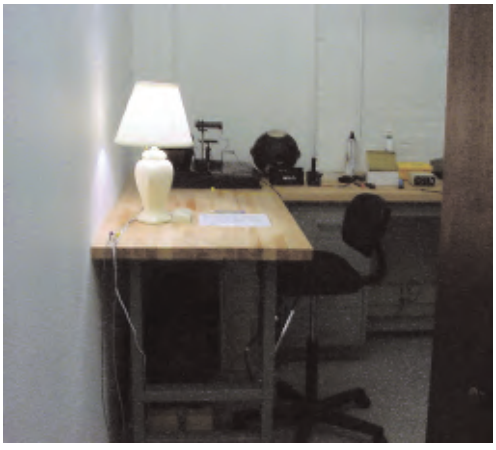
Note that because we used an incandescent lamp, both the light level and the color of the lighting changed during the 10-second ramp-up period for the third group. Ideally, we'd have liked to keep that constant, but this was just a pilot study, and we observed that the color change was hardly noticeable when it was simultaneous with the light level change.

The questionnaire contained several "distractor" questions about the distribution of light in the space and its suitability for office and storage areas. At the end of the questionnaire we also asked whether people noticed any delays or light level changes (and if so, whether these were acceptable). We also simply observed and took notes on subjects' behavior, because especially for the delay condition, the 1.5-second delay might cause some people to say the light was malfunctioning or try to turn the light switch on again.

Response to the Delay Condition

When asked if the light turned on as soon as they pressed the switch, nobody who saw the delay condition

FIGURE 1



A small table lamp was set up in a laboratory for the pilot test.

answered yes. Even for the control condition (when the light came on within about a quarter of a second) only about 30 percent said the lights came on immediately, which is probably because low-voltage filament lamps tend to have slower rise times than conventional higher-voltage incandescent lamps. When asked how acceptable the delay was (if noticed; if not, the answer was scored as very acceptable), the people who saw the control condition found the delay acceptable, while those in the delay group found it unacceptable (**Figure 2**). Additionally, we found that the delay elicited some kind of behavior in 40 percent of the people in that group—either pressing the switch again, looking under the lamp shade, or asking the experimenter about it. Nobody in the control group did anything other than start to fill out their questionnaires.

Response to the Ramp-up Condition

When asked if they detected a change in light level since they turned the light on, about 40 percent of the people seeing the ramp-up condition answered yes. While this is a larger percentage than for the group who saw the control condition, about 20 percent of the people in the control group also said the light level had changed when in fact it was constant. These "false positive" responses could be caused by the relatively slow (quarter of a second) rise time for the low-voltage lamp, or they could be mistakes from the subjects. In any case, when asked how acceptable (if noticed, otherwise the answer was scored as very acceptable) the changes in light level were, people found them very acceptable (**Figure 3**).

What Could This Mean?

It is sometimes helpful to remember that most people (IESNA members and *LD+A* readers excepted) do not obsess about the profile of light output that is created when we turn the lights on. They have other, inexplicably, more important things to do. In our small pilot study, people were focused on the questionnaire in front of them, and therefore did not have much time to spend thinking about the lighting, and whether there were unacceptable delays or changes in light level. Yes, it would have been better to use a lamp that did not change color as a function of light level, and that could be switched on more rapidly, but despite these shortcomings, our little pilot study does help us understand what matters and what doesn't for the starting and warm-up time characteristics of lighting systems.

Delays probably matter, since people found them unacceptable. Taking the Energy Star specifications and their one-second maximum delay to heart as a reasonable starting point would seem to make a lot of sense. Even shorter delays are probably better, since people even noticed the slowish

FIGURE 2

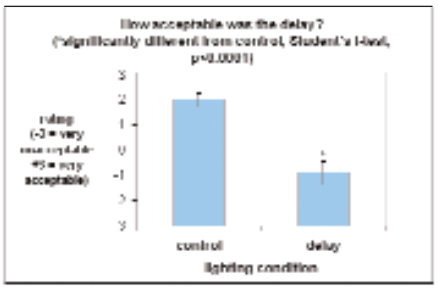
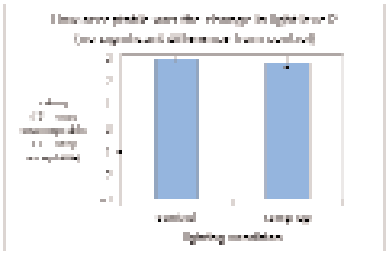


FIGURE 3



rise time (about a quarter of a second) of our low-voltage lamp in the control condition. On the other hand, initial light output that is half of the total output of a lighting system, and which rises to full output within 10 seconds, didn't seem to bother people at all in our pilot study. Of course, this assumes that the reduced light output does not compromise visibility of an important task or reduce safety (such as in a hazardous location), but this is not likely the case in most homes and offices. If increasing energy efficiency involves trading off a couple hundred lumens for a few seconds (as long as they get some to begin with), it's probably a worthwhile trade, and worth the wait.

I'd like to acknowledge the U.S. Environmental Protection Agency for supporting this pilot study, and my colleagues Ramesh Raghavan, Richard Pysar, Yukio Akashi, Jennifer Fullam and Mark Rea for their input.

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Wallace Creer

THE SIMPLEST DECISION IN lighting is "on or off?" However, dimming technology means you no longer have to limit yourself to just two choices. Dimmable ballasts allow you to explore the full spectrum of lighting possibilities between those two settings. Plus, they can provide diversity from lamp to lamp, group to group, or zone to zone.

Dimming technology can take you in two basic directions. One towards energy savings and the other towards complementary lighting—adapted to the way the space is used. Sometimes one path will lead you to both destinations, but generally speaking you are going to choose your lighting equipment for one reason or the other—not both.

The decision to pursue energy savings through dimming can be a relatively simple one. It is, after all, a matter of pure mathematics. Dimming can cut your utility bill by nearly 30 percent. Naturally this technology is more expensive than traditional lighting equipment, but usage over time saves energy and dollars.

Complementary light control through dimming can be a more complicated decision because the benefits are not so easily quantifiable. Without a doubt, environment is linked to productivity in an office, retail space or restaurant. However, it is sometimes difficult to calculate the direct relationship between improved lighting and increased productivity.

Energy Savings

How much light do you need? This is the first and most important question to ask when designing any lighting arrangement. The pitfalls of providing too little light are obvious. The problem with providing too much light is more subtle (unless you go so far as to start blinding people). Unnecessary light generally goes unnoticed until the utility bills start to pile up.

Dimmable ballasts allow you to provide only as much light as necessary. This is an effective cost-cutting technique, but it is sometimes overlooked. A much more common way to reduce utility costs is to focus on efficiency. Upgrading to higher efficiency lighting equipment does not always provide the maximum energy savings possible. A high-efficiency lamp may provide the most light for the least cost, but what if that light is unnecessarily bright? Efficiency is only half of the answer. Once you minimize the amount of electricity needed to produce light, you must also minimize wasted lumens in order to get the most out of every energy dollar. This requires precise control.

Dimming is all about control. As demand for lighting changes, so does output. The lighting will adjust—manually or automatically—to fit the situation or time of day. This allows you to curb energy use and minimize costs.

Step Dimming. Certain ballasts can provide incremental light-level switching, also known as "step dimming." This allows the lamp to switch between two or three power levels. In other words, you can dim the lights to 50 percent at the flip of a switch. Of course, there is a simpler method to achieve similar results: just turn off half of the lamps. However, this solution creates uneven lighting. By dimming the lamps instead, you maintain uniform illumination. This is preferable for safety reasons, as well as comfort and visual appeal.

Analog Dimming. Another energy-saving style of ballast is the 0-10-V analog dimming ballast, which has become common in office buildings that employ daylight harvesting techniques. Analog dimming technology is a cost-effective choice for single-zone applications where all lamps are dimmed to the same level simultaneously. Unlike step dimming, this technology allows for continuous dimming from full brightness down to about one to three percent in most cases. These ballasts are compatible with a wide variety of popular controls and photocells, and they facilitate compliance with strict energy-saving requirements such as California Title 24 and ASHRAE-IESNA 90.1.

With digital dimming, all setup and programming are done via the controller. Changes can be made at any time without opening a single fixture or touching a single wire.

Daylight harvesting—where photocells detect the amount of natural light in the room and dim the ballasts accordingly to avoid unnecessary energy use—is a highly effective use of automated controllers to cut utility costs. And they can often be used in conjunction with occupancy sensors and schedulers.

Complementary Light Control

The previous ballast designs are effective if you want every lamp to perform the exact same task, such as dim to 50 percent when the sun is bright. On the other hand, you may require a more sophisticated way to control your environment. If you need different lamps to respond in different ways, you will need a programmable network of ballasts.

A lighting arrangement, like all other aspects of architectural design, must contribute to the functionality of the space. In other words, it must help the occupants achieve their goals—whether the goal is relaxation, retail sales, office work, public speaking, etc. Multi-use rooms are therefore going to require multiple lighting arrangements.

Programmable lighting arrangements allow you to adapt your environment to changing situations with the touch of a button. This versatility can be a valuable tool. For example, an auditorium may require numerous lighting arrangements for a single event. A restaurant may wish to adapt its ambiance numerous times throughout the day, from business lunches to family dinners to late-night romantic dining. The purpose is always to increase productivity, however it is measured.

Certain ballasts allow for step dimming.

Digital Dimming. Digital dimming allows for dynamic, programmable lighting arrangements. This technology enables multiple light types (fluorescent, halogen, incandescent, etc.) to operate on a single circuit and yet be controlled individually. A wall-mounted controller or handheld remote is generally used to program the lamps, either one-by-one or grouped into zones. With digital dimming, all setup and programming are done via the controller. Changes can be made at any time without opening a single fixture or touching a single wire. This innovative technology is perfect for sophisticated dimming environments such as conference rooms, hotel lobbies, restaurants, classrooms, and more.

DALI. An alternative digital dimming provides new dimensions in versatility, programmability, and scalability. Digital Addressable Lighting Interface, or DALI, is the new industry standard for digital communications between ballasts and control systems. DALI technology allows a limitless variety of lighting groups, and each one can be programmed to perform multiple commands at the push of a button. Commands include on/off, light level control and scene recall. Ballasts can be controlled individually or in groups, corresponding to rooms or functional areas—providing maximum flexibility.

Since DALI is a standard IEC protocol, numerous manufacturers are

Daylight harvesting—where photocells detect the amount of natural light in the room and dim the ballasts accordingly to avoid unnecessary energy use—is an effective use of automated controllers to cut utility costs.

DALI technology allows a limitless variety of lighting groups, and each one can be programmed to perform multiple commands at the push of a button. Commands include on/off, light level control and scene recall.

exploring this technology. Wall station devices make initial programming and daily operation simple and convenient. Although a wall controller is all that is necessary to effectively control a DALI digital dimming system, this technology also allows for two-way communication between the ballast and a central computer controller.

Other technologies only allow the controller to issue orders and do not allow the ballast to "talk back." With DALI, the ballast can alert the controller when a lamp fails. Monitoring ballast-to-controller communication can also help identify new opportunities to save energy and reduce maintenance costs.

Choose Your Path

Digital dimming can, of course, duplicate all the energy-saving features of step dimming and analog dimming ballasts. However, as you would expect, more capable technologies are more expensive. In many cases it is unnecessary to invest in a digital dimming technology such as DALI for simple daylight harvesting or other energy-saving reasons.

Analog dimming ballasts could potentially be engineered to achieve some of the versatility of more advanced technologies. Extensive wiring might allow you to design a small number of complex lighting arrangements that you could switch between with the touch of a button. However, these ballasts could only be grouped into zones by wiring, not by software. Changing the zones or designing new arrangements would require a great deal of labor.

Whether new construction or retrofit, choosing wisely will pay off in terms of savings and productivity. Fortunately, the diversity in dimming products and technology demonstrates that there is a ballast solution tailor-made for everyone.

Wallace Creer is dimming product manager for Universal Lighting Technologies, Nashville, TN. His 21 years of professional experience includes R&D, product development engineering and product management.


Brian Liebel, PE

AN IMPORTANT DEBATE IS taking place in the lighting community, one that requires a good slap in the face. No, not an insulting or punishment slap; more like the one you give yourself in the shower to wake up in the morning...what you need to snap out of a bad dream and come to your senses.

What I'm talking about here is the Vision Thing—the debate in the industry about whether or not the 20/20 vision standard adopted by vision science and optometry has practical use in assessing the effectiveness of lighting. The two sides in this debate often delve into nuanced terminology that many of us don't recognize, and we're left wondering what each side is saying.

Background

In the field of spectrally enhanced lighting, there are three undisputed visual effects resulting from relative increases in the shorter wave length (blue/green) content of a light source: for the same light level, there is increased brightness perception, a reduction in pupil size and measurable improvements in visual acuity at the optometric standard of 20/20 vision, or threshold. While these results are generally agreed upon, the *importance* to lighting practice of the visual acuity improvements is highly debated. One side of the debate (Group A) states that changes in vision occurring at the threshold condition where acuity is determined are relevant to lighting practice; the other side (Group B) states that changes in vision at this level of refinement are too small to matter, since reading material in normal applications is never that small.

> Should we, as lighting professionals, use a different standard than optometrists?

At issue is whether vision improvements resulting from changes in the spectral properties of light have measurable effects on vision *that matter*. It is a critically important question to ask, since empirically derived application factors for spectrally enhanced lighting are based in part on improvements in visual acuity at the optometric standard, and these application factors have direct lighting and energy consequences. If this threshold level of refined vision really doesn't matter, perhaps the application factors aren't pertinent to lighting practice.

At its core, however, this debate goes well beyond spectrally enhanced lighting—it is a fundamental disagree-

ment over the use of a well-established standard to assess the effects of lighting on human vision. Should we, as lighting professionals, use a different standard than optometrists?

What is Visual Acuity?

When you go to the optometrist, you are asked to read various letters of smaller and smaller size, until you can't read the letters anymore. Optometrists test for "normal" 20/20 vision, which corresponds to the visual capability to distinguish letters with a stroke and gap size of one minute of arc. Letters are used in vision testing because they are easily recognized, content neutral and easy to use—the fine details at this threshold limit are picked up through common mistakes of seeing a "P" when it's really an "F," or an "O for a "C," for example. The optometrist knows full well that you don't usually read letters this small; it's just that having the ability to discern this level of detail ensures your best level of resolution and visual comfort.

Which leads us to the fine point of the debate—Group A researchers have shown improved visual acuity resulting from spectrally enhanced lighting when testing at 20/20[1,2,3,4,5], while Group B researchers investigating the spectral effects of lighting under the less exacting criteria of 20/30 vision (1.5 minutes of arc) have not found visual performance improvements[6]. Group B argues that testing at the 20/20 acuity limit is irrelevant, on the premise that there are no real office tasks that use letters that small, while Group A argues that it is entirely predictable that there would be no difference in task performance when people are tested at 20/30, since anyone with normal 20/20 vision should easily be able to identify letters sized at 20/30 under a wide variety of lighting conditions.

Why Does It Matter?

Let's analyze this debate through a simple question: *What is the difference between 20/20 and 20/30 vision, and what do we miss in the interval between?* In other words, if we decide that anything smaller than 20/30 doesn't matter, let's find out what we are missing if we corrected our vision to 20/30 instead of 20/20!

Try this test with your optometrist: Once you have your vision set at 20/20 (with corrective lenses or not), have your optometrist put letters on the wall that are sized to 20/20 vision. Read the letters with both eyes relaxed and without the machine in front of your face so you have full-field-of-view. Now, ask the doctor to put lenses in front of your eyes—corrective lenses that change your vision to 20/30 and you'll see that you can't read the 20/20 letters anymore. Aim your gaze at other things in the room that are the same distance away as the letters (say the corner of the room), and alternate your viewing between your precise 20/20 vision and the 20/30

lenses—first you see clearly, then you don't. The difference in your clarity of vision is what you are missing if you assume that 20/30 vision is good enough.

Finally, return to your 20/20 vision and ask your optometrist to alternate the letters between 20/20 and 20/30, and see how easy the 20/30 letters are to read. See the difference? Clearly, the 20/30 letters are much easier to read and therefore provide a much larger margin of error for making mistakes when being tested.[7]

Group B argues correctly that you never find words printed at the very small threshold size of 20/20. Group A agrees with this observation, but clarifies the reason; vision studies consistently conclude that typeface must be sized at least three to four times threshold (minimum 20/60 vision for normal-vision people) to read comfortably without slowing down.[8, 9, 10, 11, 12, 13] For example, at a 14-in. viewing distance, newspaper typeface is at the three times threshold, or 20/60 size, while telephone book typeface is sized smaller at two times threshold, or 20/40 size—that's why we squint, move closer, use a magnifying glass or just read slower when reading the phone book. The key point here is that the reference point for reading speed is threshold, and that fine adjustments in vision at the threshold level impact reading speed and visual comfort for normal reading tasks.

When vision is tested with letters whose smallest size is 20/30, the testing lacks the resolution necessary to assess real vision impacts and gives a false sense of security to those who claim there are no benefits to testing at more refined levels. It's like testing a steak knife for its ability to cut a thick steak by using a stick of butter as the test case—sure it can cut the butter, but what about the steak? The test leaves us with irrelevant information, when what we really need is the guarantee that we have the sharpest knife in the drawer.

20/20 Threshold

The importance of visual resolution at the threshold limit of 20/20 vision cannot be summarily dismissed. Small refinements in visual acuity directly affect both visual comfort and reading speed, facts well established in vision science.[8] Furthermore, optimizing visual acuity is critical to minimizing eye strain and reducing posture problems, such as hunched backs from reading legal contracts or extended necks from reading Internet pages on your computer.

Visual performance tests using 20/30 letters that are one-and-a-half times the size of the normal visual acuity limit miss the point of vision testing and underestimate the real effects of clear and precise vision. If you still question the validity of the optometric standard and its importance to lighting, take a cold shower and slap yourself real hard—size does matter, and in this case, the smaller the better.

At issue is whether vision improvements resulting from changes in the spectral properties of light have measurable effects on vision *that matter*

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7. If you aren't going to the optometrist soon, try downloading a vision test on your computer, like the one at *www.tucows.com/get/34305-1_130290*—it's free! Make sure you calibrate the screen to the correct size and take the test at 10'-0" away—otherwise the pixelization on the computer won't provide the appropriate resolution—and have a friend help you conduct the test. See the difference in 20/20 and 20/30?

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Brian Liebel is principal of Afterimage + Space, an architectural, engineering, and lighting design and research firm. During his 20-year professional career, he has consulted for numerous projects and firms as a lighting designer, electrical engineer, lighting educator, exhibit designer, lighting researcher and product developer. He has received several local, regional, and national lighting design awards and is currently the principal investigator for research in the field of spectrally enhanced lighting for the U.S. Department of Energy. Comments addressed to the author on this column can be addressed to LDA_hotbutton@yahoo.com

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ILLUMINATING ENGINEERING SOCIETY NEWS

Obituary - Frederick A. Dickey, 68

Frederick A. Dickey, a long time electrical lighting engineer with General Electric and Member Emeritus of the IESNA, died on July 26 at the age of 68. Born in Pittsburgh, PA, Mr. Dickey received a bachelor of science from Ohio University, Athens, and a master's degree from the University of Tennessee, Knoxville.

After his retirement in 2000, Mr. Dickey worked with Major League Baseball (MLB) as a lighting and field consultant. He was also a strong supporter of the "Bright Idea" program, which promotes the use of energy efficient, compact fluorescent lamps as a fundraising initiative for schools and community non-profits located in North Carolina.

Mexico Section Takes Lighting Journey

The IESNA Mexico Section's 7th International Lighting Journey was held in July at Banamex Convention Center in Mexico City. Highlights included presentations by Craig Bernecker, IESNA past president, who discussed lighting of public spaces; Naomi Miller, who spoke on vision and comfort factors in lighting; and Penn State's Rick Mistrick, who discussed daylighting. Pictured are the speakers and section officers, from left to right: top—Peter Petersen, Pedro Garza, Marco Gongora, Scott Padios (Southwest Regional VP), Luc Lafortune, Craig Bernecker, Fred Oberkircher, Alain Guilhot and Jose A Fernandez; bottom—Victor Palacio, Leo Mendoza (Regional IIDA chair), Naomi Miller, Juan P. Ruiz, Lisa Ishii, Rick Mistrick and Joaquin Linares.

For more information on the 8th Lighting Journey in Mexico City, email Victor Palacio, section president at iesna-mexico@ideasenluz.com.mx

Members In The News...

Paulette Hebert was promoted to professor at the University of Louisiana at Lafayette. She previously taught in ULL's School of Architecture as an assistant and then associate professor for the past 10 years. She will continue to serve as the director of the Facility Design and Management Studio at ULL, as well as the owner of Ph.D.esign, a lighting consulting firm.


Hebert

Leviton Manufacturing Company, Little Neck, NY, appointed **David Weigand** to the position of product manager for Lighting Management Systems.


Weigand

Luxo Lamp Ltd named **Claude Blache** as national sales manager for the Luxo and Burton product lines in Canada.

Bruck Lighting Systems promoted **Ken Esterly** to the national sales director position. Esterly, who will be based out of Chicago, has previously served as the eastern sales and international LED director.

Lightolier Controls has named Rob Stredde as regional sales manager for the North Central United States. Based out of Chicago, IL, Stredde will support the sales of both Lightolier Controls and Entertainment Technology.

IESNA Calendar of Events

January 8-10, 2006
IESNA CENTENNIAL CONFERENCE
Contact: Valerie Landers
212-248-5000 ext.117
www.iesna.org

SUSTAINING MEMBERS

The following companies have elected to support the Society as Sustaining Members which allows the IESNA to fund programs that benefit all segments of the membership and pursue new endeavors, including education projects, lighting research and recommended practices. The level of support is classified by the amount of annual dues, based on a company's annual lighting revenues:

Copper:
$500 annual dues
Lighting revenues to $4 million (Copper members are listed in one issue of *LD+A* each year, as well as in the IESNA Annual Report.)
Silver:
$1,000 annual dues
Lighting revenues to $10 million
Gold:
$2,500 annual dues
Lighting revenues to $50 million
Platinum:
$5,000 annual dues
Lighting revenues to $200 million
Emerald:
$10,000 annual dues
Lighting revenues to $500 million
Diamond:
$15,000 annual dues
Lighting revenues over $500 million

DIAMOND

Cooper Lighting
General Electric Co.
Lithonia Lighting
OSRAM SYLVANIA Products, Inc.
Philips Lighting Co.

EMERALD

Holophane Corporation

PLATINUM

Day-Brite Capri Omega
Lightolier
Lutron Electronics Co, Inc.

GOLD

A.L.P. Lighting Components Co.
Altman Lighting Inc
The Bodine Company
Canlyte Inc.
Con-Tech Lighting
Duke Power Co.
Edison Price Lighting, Inc.
Finelite, Inc.
Florida Power Lighting Solutions
Gardco Lighting
Indy Lighting, Inc.
Kenall Mfg Co.
The Kirlin Company
Kurt Versen Co.
LexaLite Int'l Corp
Lighting Services Inc
LiteTouch, Inc.
Louis Poulsen Lighting
LSI Industries, Inc.
Lucifer Lighting Co.
Martin Professional, Inc.
Musco Sports Lighting, Inc.
Niagara Mohawk Power Corp
Prudential Lighting Corp
RAB Lighting, Inc.
San Diego Gas & Electric
SPI Lighting
Vista Professional Outdoor Lighting
The Watt Stopper Inc.
Zumtobel Staff Lighting, Inc.

SILVER

Ardron-Mackie Limited
Arkema Inc.
Associated Lighting Representatives. Inc.
Atofina Chemicals, Inc.
Bartco Lighting, Inc.
Barth Electric Co., Inc.
The Belfer Group
Beta Lighting, Inc.
Birchwood Lighting, Inc.
BJB Electric Corporation
Border States Electric Supply
Bulbrite Industries, Inc.
Celestial Products
City of San Francisco
Con Edison of New York
Custom Lighting Services, LLC
Custom Lights, Inc.
Day Lite Maintenance Co.
Eastern Energy Services, Inc.
Eclipse Lighting, Inc.
Elko Ltd
Elliptipar
Enmax
Enterprise Lighting Sales
ETC Architectural
Eye Lighting Industries
Eye Lighting Int'l of NA
Fiberstars
Focal Point
Gammalux Systems
H E Williams, Inc.
HDLC
Illuminating Technologies, Inc.
Kramer Lighting
Lee Filters
Legion Lighting Co.
Leviton Mfg. Co. Inc.
Lightology LLC
LiteTech
Litecontrol Corp
Litelab Corp
Litetronics Int'l Inc.
Lowel Light Manufacturing
Lumascap USA Inc.
Manitoba Hydro
Manning Lighting
Metalumen Manufacturing, Inc.
New York State Energy Research & Development Authority
OCEM/Multi Electric Mfg. Inc.
Optical Research Associates
Paramount Industries, Inc.
Peter Basso Associates, Inc.
Portland General Electric
Prescolite, Inc.
Reflex Lighting Group, Inc.
Richard McDonald & Associates, Ltd. - Calgary
Richard McDonald & Associates, Ltd. - Edmonton
Sentry Electric Corporation
Shakespeare Composites & Structures
Solar Outdoor Lighting
Southern California Edison
Sternberg Vintage Lighting
Strand Lighting, Inc.
StressCrete King Luminaire Co.
Tennessee Valley Authority
Universal Electric Ltd.
US Architectural Lighting/Sun Valley Lighting
Utility Metals
Velux America Inc.
WJ Whatley Inc.
WAC Lighting, Co.
Wisconsin Public Service Corp
Wybron, Inc.
Xenon Light, Inc.

IES SUSTAINING MEMBERS

As of September 2005

New Members

Membership Committee Chair Paul Mercier announced the IESNA gained one Sustaining Member and 81 members (**M**), associate members and student members in September.

Sustaining Members
The Watt Stopper Inc., Santa Clara, CA

Canadian Region
Barbara A. Bennett (**M**), Cooper Lighting Canada, Toronto, ON
Tim Moggridge (**M**), Instrument Systems, Ottawa, ON
Janet Wicks, Janick Electric Limited, North York, ON

East Central Region
Taylor Adair (**M**), Lamina, Westhampton, NJ
Sarah Bucher, B2E Consulting Engineers, Leesburg, VA
Steve A. Camillucci (**M**), Pace Collaborative, Virginia Beach, VA
Walter S. Farley, Langhorne, PA
Garrett E. Fox, Spears/Votta & Associates, Inc., Fallstone, MD
Emad A. Hasan (**M**), The Lighting Practice, Inc., Philadelphia, PA
Mickel D. Johnson, City of Richmond - Department of Public Utilites, Richmond, VA
Kenneth H. Powell (**M**), AKF Engineers, LLP, Philadelphia, PA

Great Lakes Region
Dean A. Thornberry, Holophane, Newark, OH

South Pacific Coast Region
Steven Holdaway, Associated Lighting Representatives, Oakland, CA
Michael Koolhoven, A&F Engineering Group, Inc., Rancho Cucamonga, CA
Thom Petrush, Vista Professional Outdoor Lighting, Simi Valley, CA
Dean Pournaras, The Watt Stopper, Inc., Santa Clara, CA
Duane S. Price, Corona, CA
April Ruedaflores (**M**), Architectural Area Lighting, La Mirada, CA
Garland K. Wong, City of Concord, Concord, CA
Darrin Wood, Vista Professional Outdoor Lighting, Simi Valley, CA

Midwest Region
Stephen R. Baim, Ranken Technical College, Edwardsville, IL
Michael T. Dudek, Kansas State University, Manhattan, KS
David A. Exe (**M**), Industrial Engineering, Inc., Woodbury, MN
Terrance Maskil (**M**), Malone Finkle Eckhard & Collins, Inc., Shawnee, KS
William R. Oliver (**M**), Creative Lighting & Associated Systems, Inc., Elkhorn, NE
Dirk A. Rannebarger (**M**), Daily & Associates, Engineers, Inc., Champaign, IL
Joseph A. Regis, Robert E. Hamilton Consulting Engineers, PC, Joliet, IL
Tejinder S. Thethi (**M**), Techknow Engineering, LLC, Chicago, IL
Laura Vogel, Muermann Engineering, LC, Kiel, WI
University Of Nebraska, Omaha
Derek Bentz, Garrett Galyen, Brett Garner, Samuel Haberman, Kent Krause
John McCart, Chrysanthi C. Mishek, Misty Owings, Cerone Thompson
Jon Turner, Andrew Wilson
Milwaukee School of Engineering
Christopher Durham

Southeastern Region
DuWaynne G. Rettke, Hudson, FL
University of Alabama
Mae Beth Aden, Lauren Bacon, Mandy Buck, Sarah Cole, Kathlen Cowley, Laura Ruth Edge, Katherine Field, Michael J. Hand, Christine Lankey, Miranda Lawrence, Audrey Layton, Bradley Logan, Lacey Moseley, Lydia Peavler, Carolyne D. Perry, Deasy Phillips, Melody Riddle, Amelia Smith, Lisa Vandillon

Northeastern Region
Michael A. Lunn, PCI Lighting Control System, South Burlington, VT
Sergio Mazon (**M**), Mazon Lighting Design, Boston, MA
John Micelotta (**M**), Expert Electric Inc., Astoria, NY
Adam Ying, Jesco Lighting, Inc., Ridgewood, NY
University of Bridgeport
Vicki Kohanek

Northwest Region
Morena A. Delrosario EIT (M), URS Corp., Seattle, WA
Ernest Kim (**M**), ODOT Traffic, Salem, OR
Barry Locken, Wesco Distributions, Nanaimo, BC
Mark Morris (**M**), Morris Engineering Group, LLC, Juneau, AK
Yvon Pelletier, Prolux Lighting, Calgary, AB
Kenneth T. Ratcliffe (**M**), AMC Engineers, Anchorage, AK
Ross G. Reiniger (**M**), Holophane, Calgary, AB

Southwestern Region
Jonathan A. Carter, ccrd Partners, Dallas, TX
Steven G. Martin, SiGMA, Boulder, CO
Patrick Murray (**M**), Philips Lighting Co., Sugar Land, TX

Southern Region
Robin E. Johnson, Equinox Energy Systems, Inc., Marietta, GA
Chad W. Luttrell, Loganville, GA
Terry D. Norwood (**M**), Echelon Eng., Charlotte, NC
Ronald C. Ray, Equinox Energy Systems, Marietta, GA

International
Itzhak Hershkovich, Ma'tz, The Israeli National Roads Co. LTD., Or Yehuda, Israel

Baton Rouge's State Police headquarters compound served as the staging area for the first responders, and all the law enforcement personnel and federal agencies who were stationed in the area.

Photos: J.R. Finkle

The Lighting Industry Responds To Hurricane Katrina

Members of the lighting community have come forward with contributions of products and dollars in the aftermath of Hurricane Katrina.

- SOL Inc., Palm City, FL, in conjunction with Louisiana State Police, has installed 30 solar-powered lighting systems at designated areas in and around New Orleans. The lighting system utilizes the sun's energy to charge batteries during the day, which then powers the lights throughout the night. The energy is free and wireless, so the lights can be installed quickly and then moved to other locations as needed. Members of Tiger 21, a New York City learning group for investors, provided $230,000 in emergency donations, while Sharp Electronics Corporation contributed solar panels with an approximate value of $40,000.
- Acuity Brands, Inc., and its employees have contributed $250,000 of assistance to victims of Hurricane Katrina. The company's subsidiary, Acuity Brands Lighting, donated the use of an idle 160,000 sq ft facility in the metropolitan Atlanta area to serve as a relief center for dozens of organizations providing relief to victims, including the United Way, American Red Cross, Goodwill Industries, Traveler's Aid, and various other federal, state and DeKalb County agencies.

  The facility has enabled people to register children in local schools, locate long-term housing, forward mail, receive food, clothing and financial assistance, and find other needed relief services under one roof. During its first week of operation, the facility helped almost 5000 families including placing 2250 families in long-term housing.

  Acuity Brands Lighting also responded to FEMA's request for emergency lighting for a temporary housing site near New Orleans by providing 200 Lithonia Lighting brand Dusk-to-Dawn fixtures.
- A group of Utica, NY, businesses including Meyda Tiffany collected supplies, including ready-to-eat food, bottled water, work gloves, trash bags and other emergency relief supplies to aid Feed The Children: Hurricane Katrina Emergency Relief Fund.
- On behalf of its corporate staff and North American sales agents, Nora Lighting, Commerce, CA, has made a donation to Feed The Children: Hurricane Katrina Emergency Relief Fund.

LRC To Redefine National Roadway Lighting Guidelines

The Lighting Research Center (LRC) at Rensselaer Polytechnic Institute, Troy, NY, was awarded a contract from the National Cooperative Highway Research Program (NCHRP), a division of the National Research Council's Transportation Research Board (TRB), to redefine national roadway lighting guidelines. The three-year, $800,000 project is designed to improve the operational efficiency of roadway lighting and reduce automobile crashes.

As part of the project, LRC researchers will produce user-friendly guidelines for roadway lighting and a calculation tool to help determine what type of roadway lighting, if any, is required. The calculation tool is intended to be an algorithm that weights safety, cost and other impacts of lighting such as light pollution, economic development and security. The calculation tool will factor in details such as road geometry, traffic characteristics, number of pedestrians, glare, and interactions between headlamps and streetlights.

"The LRC will perform crash analyses and lighting studies through site evaluations and computer modeling for a wide range of conditions and roadway classifications," said John Van Derlofske, Ph.D., head of transportation lighting at the LRC and principal investigator on the project.

The LRC also partnered with researchers from the Pennsylvania Transportation Institute at Penn State University Park, who will receive a portion of the funds to assist in performing traffic data analysis for the project. Students enrolled in LRC's graduate education programs will participate in the project, assisting in laboratory testing, data analysis and on-site evaluations.

Additional information on the Transportation Lighting Group and its research can be found at *www.lrc.rpi.edu/programs/transportation*

Energy Design Guide Earns Award from Alliance

The Washington, DC-based Alliance to Save Energy has recognized the *Advanced Energy Design Guide for Small Office Buildings* with an honorable mention as part of its annual Stars of Energy Efficiency Awards. The award was presented at a luncheon seminar program at the Alliance offices in Washington.

The guide was developed by a committee of energy professionals drawn from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the lead organization on the project, the American Institute of Architects (AIA), IESNA and the New Buildings Institute (NBI) with support from the U.S. Department of Energy.

The guide provides recommendations on how to build energy-efficient small office buildings that use significantly less energy than those built to minimum code requirements. Copies are available from the IESNA publications department (Order #AEDG-1-05 List Price: $59.00 and Member Price: $47.00)

From left to right: Harvey Sachs, American Council for an Energy-Efficient Economy, representing NBI; Ronald Majette, U.S. Department of Energy; Kateria Callahan, President, Alliance to Save Energy; Don Colliver, chair of the AEDG committee, ASHRAE; William Nitze, Alliance Board member; Rita Harrold, IESNA; and Richard Hayes, AIA.

Call for Entries: 'It's Your Light' Student Design Competition

Florida lighting manufacturer Luraline Products Company has announced the Call for Entries for its fifth annual "It's Your Light" student design competition. The 2005-2006 competition, which solicits new concepts for lighting fixtures from design and architecture students, focuses on RLMs.

RLMs are shade fixtures, which may be pendant, wall or post mounted, and are used to provide illumination of exterior parking lots, facades and signage, as well as interior accent or general area lighting in restaurants, cafes, stores and shopping centers.

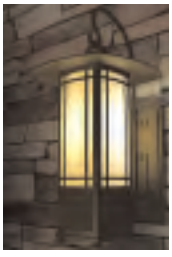
As in past years, entries will be judged by a panel of industry experts based on creativity and feasibility of the design. The winner will receive a cash prize of $1500 and the winning design may be put into production by Luraline. The competition is open to students enrolled in design and architecture programs at U.S. universities, colleges and technical schools. Deadline for entries is December 31, 2005. For more information go to *www.luraline.com*

Ferros Chandelier

Lighting For Tomorrow Names 2005 Design and Technology Winners

Lighting for Tomorrow's 2005 Design and Technology Competition Awards were presented at the American Lighting Association Annual Conference in Miami Beach, Fl.

Taking the competition's grand prize of $15,000 was Lithonia Lighting, Conyers, GA, who won the top design in the Indoor Fixture Family category with its Ferros indoor fixture. American Fluorescent Corporation, Waukegan, IL, also captured the top awards in the Outdoor Fixture Family with the Eureka outdoor fixture and the Technical Innovation categories with the Chablis-Soleil chandelier.



Eureka Outdoor Sconce

Los Angeles-based Justice Design Group was awarded $7500 for second place in the Indoor Fixture Family category. Three other designs received honorable mention, one (Lighted Mirror) by Good Earth Lighting, Wheeling, IL; and two (Flipster and Lulu) by Fire & Water, New York, NY.

For this year's competition, specific objectives focused on indoor and outdoor fixture families as well as innovative designs that addressed technical barriers to energy-efficient lighting. In order to qualify for the 2005 competition, all prototypes had to meet Energy Star criteria. For further information, visit *www.lightingfortomorrow.com*

Photo: Chuck Pappas

Updated Track Lighting is the Favored Flavor

"A bottle of white, a bottle of red, perhaps a bottle of rose instead." Singer Billy Joel famously described the indecision that many experience when attempting to find the right bottle of wine.

Rather than just stock different types of wine, the owners of Englewood Wine Merchants, Englewood, NJ, also created retail displays and designated tasting stations that give patrons the opportunity to learn more about wine selection.

The Project: Englewood Wine Merchants, Englewood, NJ

The Challenge: Highlight the labels on wine bottles while complementing store design without distracting customers.

The Solution: Low-voltage track lighting system and cylinder fixtures

Opened in May 2005, the store's main room is 15 ft wide x 60 ft long, with 10 ft high dark ceilings. Illuminating this space was an outdated track lighting system that was large and cumbersome. Ownership wanted a lighting solution that would suit the room and directly highlight the labels on the wine bottles without distracting customers. They contracted with Ken Mackenzie, vice president and general manager of Lightolier's Track Lighting Business Unit, who acted as the store's lighting consultant.

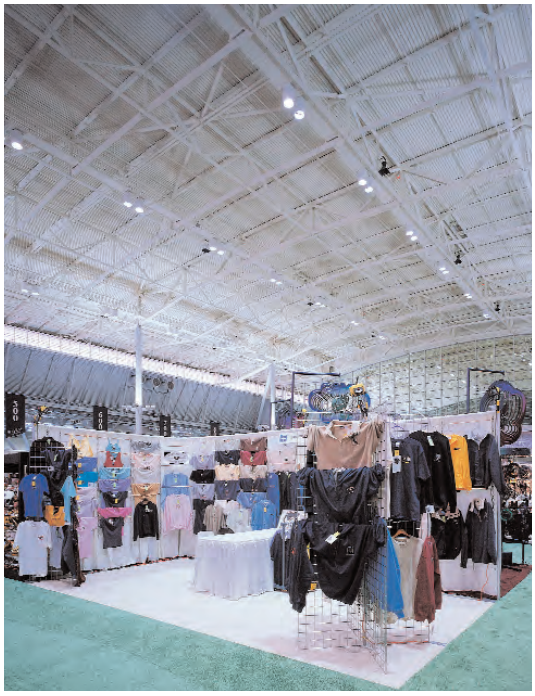
Mackenzie studied photographs of the space in order to make a suitable product recommendation. What he found was that because of the depth of the retail space—and dark color of the ceiling and walnut cabinetry—the area would require high-intensity white light that could be focused accurately on the wine displays and tasting stations. "I recommended low-voltage MR16 lamps, which are perfect for this application because they are very bright, very white and intense, and they fit in small track fixtures that won't detract from the overall design," said Mackenzie.

The Alcyon track light features a small, unobtrusive transformer case, which rides low along the track, and the slim wireless stem provides the illusion of a floating head of light. The fixtures are also adjustable, and replacing burned-out lamps is easy because of the luminaires' lamp-forward design, which places the front of the lamp ahead of the fixture case.

Owners selected matte black low-voltage cylinder fixtures to blend with the dark ceiling and also opted for the Advent two-circuit track, which offers separate controls for each track head, so that different fixtures may be turned on or off at a given time.

—John-Michael Kobes

Custom Made Fixtures Brighten Up Convention and Exhibition Center



Photos: John Korom

With its monster facility figures (1544 ft long by 730 ft wide) the Boston Convention and Exhibition Center (BCEC) provides the flexibility to accommodate conventions and trade shows of any size.

The center's 1.7 million sq ft of total exhibition space does receive some daylight through the 107,000 sq ft of glass on the exterior walls, but facility owners weren't satisfied with the light levels. Contributing to the lighting plan was manufacturer Kramer Lighting, Sturtevant, WI, who provided more than 500 luminaires including seven custom fixture types.

"There wasn't a fixture that existed to do what we wanted to do," explains lighting designer Glenn Heinmiller of LAM Partners Inc, Boston, MA. "We needed a 1000-W narrow beam downlight—you just don't find one."

The fixtures were mounted in pairs and had to be precisely aimed to maintain uniform illumination of the floor space 90 ft below. Designers positioned them so each would cover a 30 x 30 ft area. The fixture's design also included a five-to-15 deg of beam tilt and the fixture height varies from 85 ft at the roof's center to 60 ft at the end of the hall where the roof is lower.

The Project: The Boston Convention and Exhibition Center, Boston, MA

The Challenge: Create custom, high performance fixtures to meet the project's stringent criteria, which included mounting requirements, physical size constraints and lamp technology

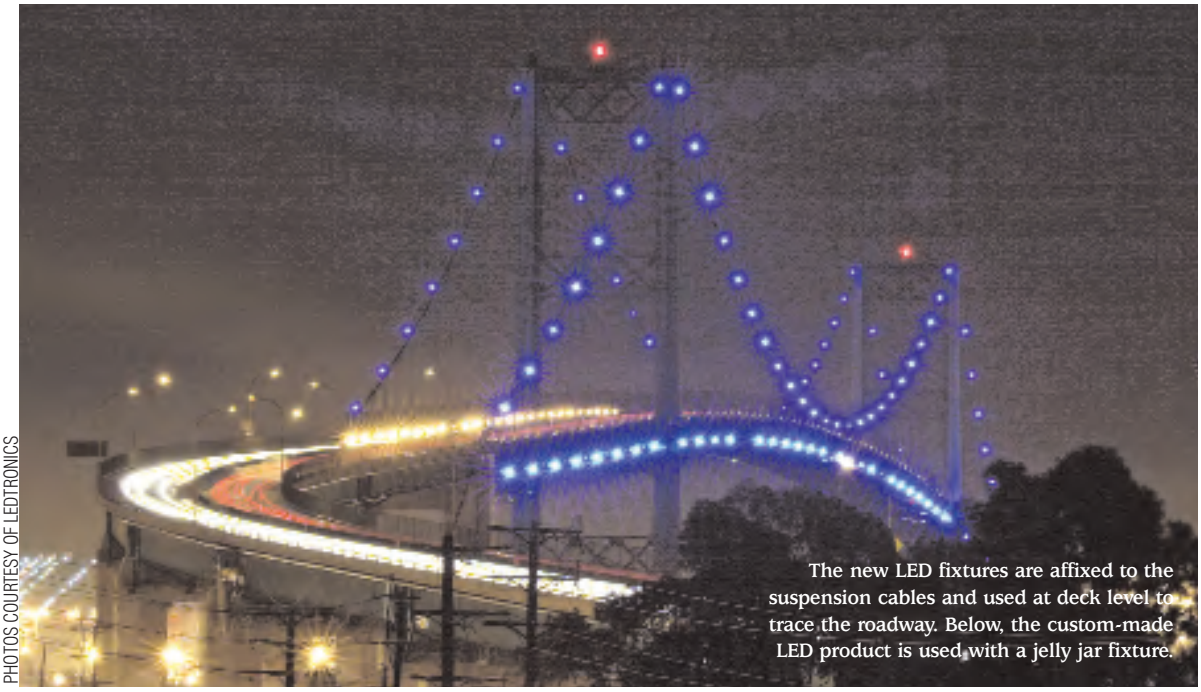
The Solution: Catwalk-mounted fixtures; pendant and surface mount downlight; and wallwash cylinder fixtures

The largest fixtures used to illuminate the exhibit hall floor measure 27 in. in diameter and 32 in. high and each includes a 1000-W metal halide lamp. The upper reflector assembly has 30 deg of total vertical adjustment to aim the fixture's beam. Tool-less access eases relamping and maintenance.

The ballast is remote mounted in a ballast box that houses a fuse and fuseholder. These fixtures are also custom-mounted in pairs to the bottom of catwalks. Access holes in the catwalk provide for re-lamping and maintenance.

In addition to the catwalk-mounted fixtures, 400-W pendant and surface-mount downlight and wallwash cylinder fixtures mount to roof supports along the walls of the convention center. These luminaires are 14 in. in diameter and 20 to 25 in. tall depending on whether they are surface-mount with remote mount ballast or pendant-mount with integral ballast. This project received a 2005 IIDA Award of Merit.

—John-Michael Kobes



PHOTOS COURTESY OF LEDTRONICS

The new LED fixtures are affixed to the suspension cables and used at deck level to trace the roadway. Below, the custom-made LED product is used with a jelly jar fixture.

FINALLY blue

DESIGNERS IN LOS ANGELES OVERCAME 17 YEARS' WORTH OF ROADBLOCKS AND SPEED BUMPS BEFORE LIGHTING THE VINCENT THOMAS BRIDGE

By Paul Tarricone

How many years does it take to make a light bulb? Five...at least that was the case in San Pedro, CA, as designers searched for a way to light the Vincent Thomas Bridge.

Truth be told, the five years needed to gain approval for the customized blue LED solution pales in comparison to the astounding 17 years it took to bring the project to fruition. A lack of funding, energy shortages, light pollution concerns, migrating birds and even a pair of nesting peregrine falcons had all thwarted previous attempts since 1988 to string lights across the mile-long span. Ironically, the fits and starts lasted so long that a new design alternative—LEDs—emerged in the intervening years.

The Vincent Thomas Bridges sits above the main channel of the Los Angeles Harbor and plays several roles in the commu-

Even in the first design, the plan was to use blue light to complement the amber light throughout the rest of Los Angeles Harbor.

nity. As the third longest suspension bridge in California behind the Golden Gate and the San-Francisco-Oakland Bay Bridge, it's a source of local pride, the "official welcoming monument of the City of Los Angeles," as well as an economic linchpin for southern California. The bridge is the main conduit through which goods flow from the harbor to the nation's network of highways, stores and consumers.

The odyssey to light the bridge began at the grassroots level. Spearheaded by the Vincent Thomas Bridge Lighting Committee, fund-raising efforts ranged from having donors "buy" a light, to bridge walks and even placing collection cans in stores. Once the mayor's office got behind the project, the city kicked in funding, while Caltrans donated engineering time.

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Stoking enthusiasm for the project was one thing, determining precisely *how* to light the bridge was another. Stakeholders in the project—all with a voice in the lighting plan—included environmental groups and astronomers, the Federal Aviation Administration, since flight paths would be impacted, the Coast Guard and the Port of Los Angeles.

Second Time the Charm

Los Angeles-based Lighting Design Alliance was involved in the project for seven years, says firm principal Chip Israel. The goal was always to use blue light, to complement the amber high pressure sodium light used throughout other areas of the harbor, but the color is about the only thing that didn't change leading up to the LED solution. "We did the first design with a local artist," says Israel. "There were four 7000-W Xenon skytrackers mounted on four columns that shot light up into the sky; metal halide floodlights; and mercury vapor lamps in clear jelly jar fixtures." That design was ultimately rejected by the California Coastal Commission due in part to cost, light pollution concerns and for fear that the light spill would attract migratory birds.

Lighting Design Alliance brought LED manufacturer LEDtronics, Torrance, CA, into the project in 1999. "We had read about the project in the *Daily Breeze* and we knew there had been fundraisers earlier," says LEDtronics's marketing manager Jordon Papanier. A new LED product, custom-made for this project, was presented to the lighting committee. Papanier describes it as a "cluster of blue LEDs inside off-the-shelf jelly jar fixtures." A total of 160 fixtures light both sides of the bridge; 80 LEDtronics units are affixed to the apex of the suspension cables and 80 LED fixtures from Farlight, Wilmington, CA, are used at deck level to trace the roadway. Each lamp is five millimeters in diameter; 360 LEDs are used per lamp; and the lamp brightness is equivalent to a 150-W incandescent lamp. Each LED fixture consumes 20 watts of power.

Israel says this second design specifically addressed the dark sky issue. "We positioned the lights so candlepower would not be aimed above the horizon. This eliminated stray light into the atmosphere." In addition, to satisfy astronomy enthusiasts, the LEDs can be turned off to accommodate "special atmospheric view-

ing conditions, like a comet," says Israel. That was enough for the design to get the green light from the state Coastal Commission. The final cost of the project was just over $1 million.

Leveraging Solar Energy

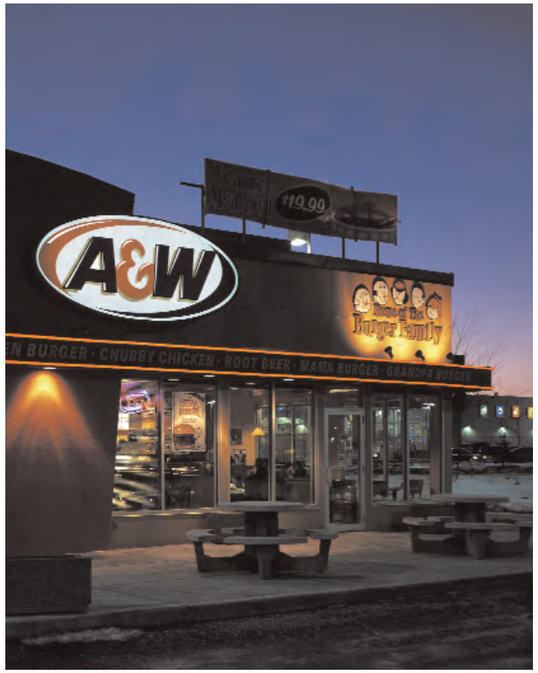
The project also showcases an innovative use of solar energy in tandem with the LED lights. A 4.5 kW solar panel system located near the bridge generates electricity that is then sold to the Los Angeles Department of Water and Power. While the LED lights themselves do not directly tap into the solar-generated power, the bridge is able to leverage solar-generated power to pay for the cost of operating decorative lighting. Each panel is two ft wide by four ft long and generates 10 watts of electricity per sq ft.

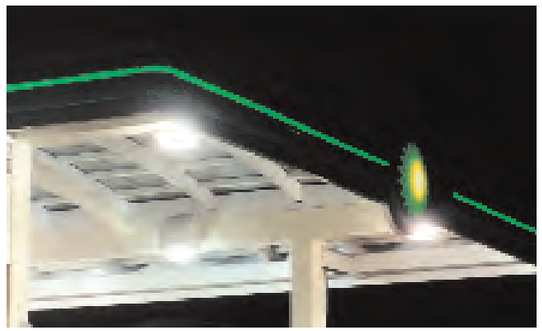
The city expects 100,000 operating hours from its LED lamps. The hours will tick away each night as the lights illuminate the Vincent Thomas Bridge between dusk and midnight. That means designers won't have to worry about new lights on the bridge for, say, another 40 years or so. That's a relief, after 17 years of waiting.

About the Designers: Chip Israel, LC, Member IESNA (1994), IALD, has been a lighting designer for over 20 years. In 1992, he founded Lighting Design Alliance. His design experience ranges from building facade lighting, to custom fixture design, to corporate office spaces, to themed hotels and resorts. Notable projects include First Interstate World Tower, Sanwa Plaza at Figueroa & Wilshire, Sony High Definition Post Production, Mission: Bermuda Triangle, Disney's Wilderness Lodge and the UCLA Site Lighting Master Plan. He has received a number of IIDA Awards of Excellence and Merit and a GE Award of Excellence.

Julie Blankenheim, LC, Member IESNA (2002), is senior designer with Lighting Design Alliance, where her work has included healthcare, retail and restaurant design, as well as commercial, assisted living, and renovation projects. Project highlights include the Tropicana Resort and Casino in Atlantic City, Bank One Plaza and the McCormick Place Convention Center West Expansion, Chicago. Ms. Blankenheim has received several IES Lumen West Awards of Excellence.

DESIGN TRENDS





LED signage can produce a quick two-year payback and provide effective corporate branding. Typical applications include gas stations, restaurants and theaters.

PHOTOS: COURTESY TIR SYSTEMS LTD

A SIMPLE ROI ANALYSIS MIGHT MAKE THE MOST COMPELLING CASE FOR LED SIGNAGE AS AN ALTERNATIVE TO TRADITIONAL NEON

Seeing Dollar Signs

By Grant Harlow

The signs are all around us. The use of light-emitting diodes (LEDs) as a replacement for neon signage may offer more potential than any other application in the drive to conserve energy. The replacement of neon is now well underway by a number of national and international retailers; LED-based lighting is increasingly being chosen for corporate identity signage in gas stations, convenience stores and fast-food restaurants. The reason is that the rugged LED technology allows for energy savings of up to 90 percent over neon, while appearing as bright or brighter and featuring greatly reduced maintenance costs.

However, as the lighting industry has found with other energy-saving technologies, new technologies such as LED-based signage can cost more in the specifying stage. They deliver exceptional financial benefits in the years after the purchase, however, so quantifying this value in terms of return on investment (ROI) can be an essential component of alleviating client concerns during the price quote stage. What follows are the key areas of the ROI analysis:

- ***Energy savings can curb retailers' electricity consumption.*** For high-volume energy consumers like retailers, LED or solid state lighting (SSL) technology holds great promise for reducing electricity consumption, a contribution that may soon be mandated by governments to preserve worldwide energy reserves and combat global warming. Other benefits, such as LEDs' optically efficient size and precise electronic control, may yield new types of signage in the future and offer alternative ways to promote corporate identities.

Conceivably, SSL could reduce lighting's usage of electricity by 50 percent or more, leading to a global reduction in the volume currently devoted to powering lights—a figure now equal to 25 percent

Cold, Harsh Reality

How cold is the western Canadian winter? So cold that the only signage used by retailer Arctic Co-Operatives Limited that would survive the severe temperatures were non-illuminated vinyl graphics or paint on plywood. And the only outdoor lighting was wall units illuminating the sides of the building.

Surely, that's no way to build a brand.

To determine the feasibility of illuminated signage, Arctic-Co-ops recently conducted a pilot test at its Rankin Inlet, Nunavut, location. With the conditions deemed too severe for neon, an LED-based system (using LightMark and LightScript products from TIR Systems and signs from Selkirk Signs and Services) was specified.

Red and green LightMark border tubes were mounted around the exterior of the building, and red LightScript was used to illuminate the red "Co-op" channel lettering on two elevations of the building.

The implementation window is very short each year. As the weather warms, installers have between July and October to undertake any work that needs to be completed before the freeze begins again. At the Rankin Inlet site both LED systems were installed before the winter of 2004-05, and reportedly there were no failures during the season.

Aside from durability benefits, Artic Co-ops hopes to leverage the aesthetic benefits of the signage system. The daytime color of the red and green border tubes is not compromised as the extrusion maintains its appearance even when switched off.

Arctic Co-ops has now arranged for two other member retail sites to be installed with the LED products.

of global electricity. In short, lighting could be the low-hanging fruit of a global energy savings program, with SSL the foundation for positive change.

• ***Lifetime cost of ownership metric.*** The lifetime (or total) cost of ownership metric—which takes into consideration that the cost of electricity and maintenance labor to operate a lighting system over time can far outweigh the initial purchase price—provides a longer-term, more realistic analysis of a signage system's ultimate true cost.

Lifetime cost of ownership includes the following: purchase price, contractor installation charges, and total estimated energy usage and maintenance costs for repair and replacement for the life of the system. For LED-based lighting, the lifespan can be more than 10 years, leveraging the energy savings potential after the initial payback period (on average 24 months or less for new installations). Any established lighting manufacturer is able to provide data on its products' energy usage and future maintenance costs. From these figures, lighting designers and engineers can calculate the lifetime ownership costs of competing systems and technologies.

• ***Payback in two to three years.*** Upfront, LED-based signage will generally cost more than neon, yet will more than make up for that initial investment by consuming up to 90 percent less energy to deliver the same or a higher level of brightness than neon over its lifetime. In addition, SSL systems' extremely low maintenance requirements mean a greatly reduced maintenance bill (as compared to replacing broken or burnt-out neon on a regular basis) over the projected 10-year life of the system.

Typically, LED-based signage pays for itself in two to three years, so that, in subsequent years, the building owner saves money on energy and maintenance. The key point to owners—be they retailers themselves or a building management company—is that the cost of LED-based lighting in the construction phase cannot be considered in isolation. In other words, taking a long-range view is critical.

• ***The environmental ROI.*** Then there are the intrinsic environmental benefits of LEDs that may come in handy in the future—i.e., if governments begin to tax energy usage or implement a system of "carbon tax credits" aimed at reducing consumption. Many business leaders agree these changes are almost a certainty in one form or another.

With lighting consuming some 25 percent of all electricity generated globally on an annual basis, and given the difficulty of siting and building new power plants, an effective LED-based system offers an opportunity for the retail industry to contribute to the cause of reducing electricity consumption in society. This is not to mention addressing incremental damage from global warming, and reducing lighting's environmental footprint.

Some Caveats

No new technology is perfect. The sign industry is littered with stories of disappointment—and sometimes failure—on the part of LEDs. Some products touting 100,000-

hour life have stopped working after only a fraction of that time. "Easy" installations have proven anything but. Rumors of fires have hurt the claims of safe operation.

However, these stories do not mean LEDs are faulty. In the early days of any new technology, it can be difficult for users to know which manufacturers' systems will work properly and which will not; consider the first computer you owned. In the particular case of LEDs, a greater awareness is needed regarding SSL systems that incorporate LEDs and other key elements of a turnkey solution.

LEDs are simply sources of light, much like a common household light bulb—or more precisely the filament inside one. A light bulb sitting on a kitchen table emits no light; before it can do its job it has to be screwed into a socket that, in turn, is connected to a source of electricity. The socket must be housed in some type of light fixture that may also include a shade or lens. Thus, the bulb is only one part of a lighting system.

Similarly, LEDs are not useful until they are incorporated into a SSL system that mounts the LED, makes a connection to a power source and houses the system components appropriately. SSL system design is complex, addressing aspects of technical engineering and design issues such as power conversion, LED control and drive, thermal management at the LED level and environmental management (sealing, temperature range) at the system level. Other important aspects include light delivery or optics, overall systems integration and ease of manufacture/installation.

If handled improperly at the design and manufacturing stages, each of these aspects can compromise a system's performance, reduce the energy savings potential and hurt the quality of light output. And, even if all of the components work individually, they are useless if they cannot work together. SSL system designs will be successful only if all components and the interaction between them have been accurately considered and tested. Failures associated with early LED signage have frequently resulted from problems with components and setup rather than the LEDs themselves. Buyers must be certain to deal with manufacturers that have the technical expertise to integrate SSL systems correctly.

And don't forget that all LEDs are not created equal. The LED source of light needs to be packaged before it can be integrated, and this is a key step to providing a reliable light source. Packaging offers a mechanical way to handle and mount the devices to a circuit board, as well as providing a means to connect to the LED electrically and, most importantly, to dissipate the heat from the LED to its surroundings. LEDs from many suppliers are useful only in certain conditions. Check the datasheet first and be sure to ask for the "useful life" characteristic before making a final selection.

The bottom line is that if you choose an experienced manufacturer, all you will need to worry about is installation; this can be as simple as straightforward replacement, with minimal disruption to business.

How Long Will They Go?

Will LEDs really last 10 years? The short answer is yes. However, when any new technology is introduced, there is a tendency for information to be misunderstood and misused. For SSL signage, the issue of "lifespan" has proved to be the most controversial of the claims made for the technology. When LEDs were first introduced as a light source for signs, proponents claimed they had a life of 100,000 hours—end of story.

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The reality, in a well-designed and manufactured SSL system, is that LEDs should last at least that long and even longer, providing the LED is run according to manufacturers' guidelines and the elements within the system support that time frame. However, the quantity of light LEDs emit will decrease over time. They do not burn out; instead, they slowly lose their intensity over time. Thus, the measurement of useful life in a signage application is different depending upon the ambient lighting conditions and the specifics of the application. The best way to consider the useful life is to consider when the sign stops attracting the eye of the customer. It is the responsibility of the SSL manufacturer to help the owner understand how their system will degrade in output over time and what impact that will have on the performance of the sign.

In the future, LEDs are likely to become a standard technology for illuminated signs. Energy and maintenance savings, along with brilliant colors, are only the beginning of making SSL technologies the dominant source for lighting signage. In the end, it is the prudent decision-making of sign makers and end users—lighting specifiers and architects, building owners and construction staff—that will advance the industry. That decision-making process can begin with a hard look at ROI.

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COME SAIL AWAY WITH LEDs

In Canada and the U.S., two waterfront Projects incorporated LED-based lighting into their Independence Day Celebrations

A COLOR VISION

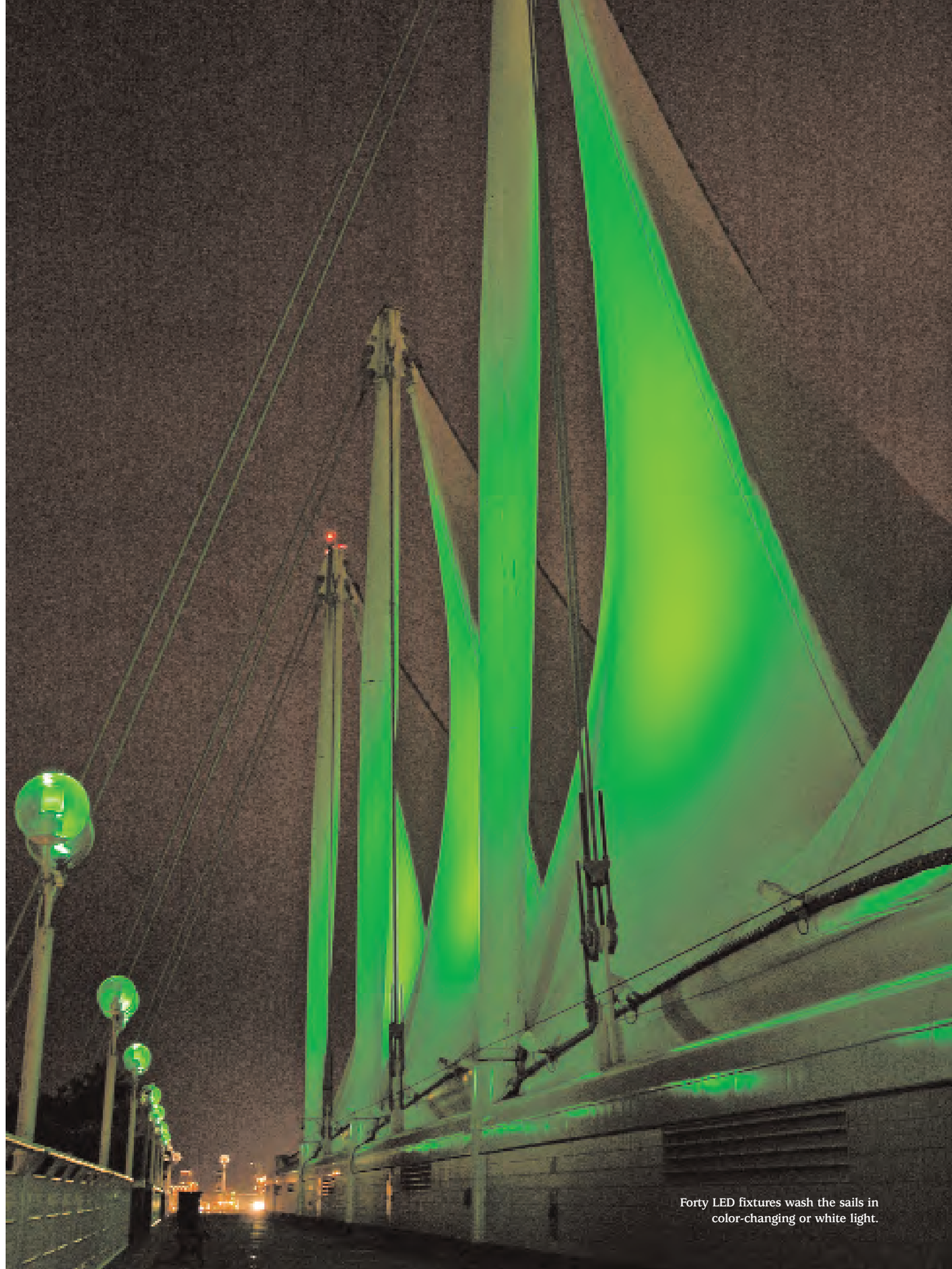
Independence Day is an opportunity for lighting designers to let their hair down and create a jaw-dropping lighting spectacle. It's just that in Canada, the fun starts three days earlier. To help celebrate Canada Day on July 1, designers transformed a once-bland lighting display at the renowned Canada Place in Vancouver, British Columbia, into a festival of LED colors.

Located on the waterfront of the Pacific Ocean, Canada Place is situated in the country's third largest city and home to its busiest harbor. The futuristic complex is approximately 2000 ft long, which comes out to just over four city blocks and features a distinctive peaked fabric roof designed to resemble an ocean liner under full sail. The mixed-use facility is also home to the Vancouver Convention and Exhibition Center, the Pan Pacific Hotel, the Vancouver Port Authority corporate offices, Cruise Ship Terminal (operated by the Vancouver Port Authority), the CN IMAX Theater, World Trade Center office complex and Citipark parking facility.

Among the building's more noticeable architectural details are its five 90-ft tall concave-shaped sails, which were previously fitted with a lighting system consisting entirely of white metal halide fixtures. Conceptualized by the Canada Place Corp. was a series of pre-programmed color combinations and shows that were composed for the Canada Day 2005 unveiling. These illuminated, nightly scenes resembled images like waves in the ocean and the Canadian Flag.

Mounted 33 ft apart on top and with a setback of 60 ft are 40 LED fixtures. Brad Fleck, regional sales manager for Illumivision, Edmonton, Alberta, said, "The Light Wave fixture has the ability to wash the surface in white and/or colored light with an impressive intensity." The LEDs were also equipped with eight-deg optics in order to reach the top of the sails, while 24-deg optics were used to fill in the middle portion of the sail.

Canada Place Corp. also wanted to reduce energy costs when illuminating the exterior. The previous system was comprised of 40 400-W white metal halide fixtures located around the building, while the new system utilizes 40 85-W color changing LED fixtures. As a result, the lighting now uses 12,600 fewer watts. "Management is able to take advantage of utility company rebates for energy saving lighting upgrades," said Fleck. The LEDs are projected to



PHOTOS: WAYNE STADLER

Forty LED fixtures wash the sails in color-changing or white light.

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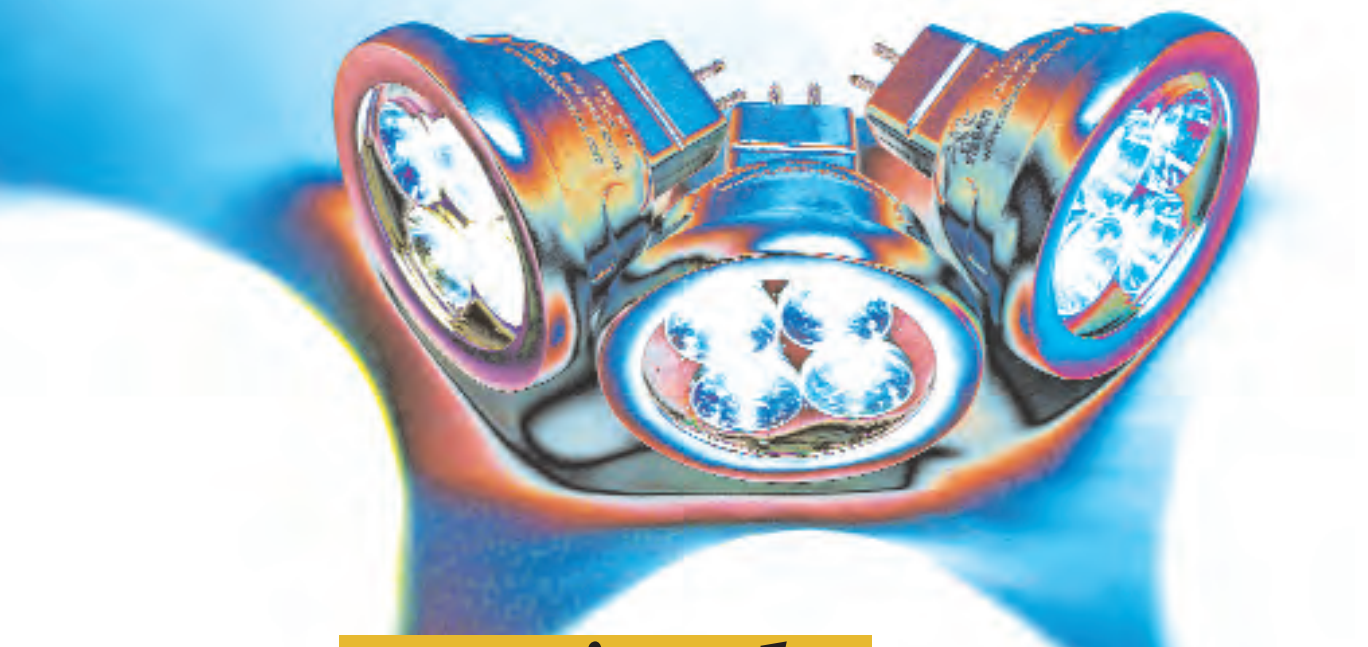
COLORED LEDS ARE ALL AROUND US, BUT ARE WHITE LEDS ALSO POISED TO MAKE THE LEAP FROM NICHE TO MAINSTREAM?



Crossing the CHASM

By Kevin Dowling

A relatively new lighting source for general illumination is light-emitting diodes or LEDs. Although LEDs have existed for decades, it is only within the past decade that output levels have been sufficient to consider them for other than indicators or direct view light sources. Red and green LEDs, augmented by blue LEDs in the late 1990s, have allowed additive color mixing to produce any color; this is similar to your computer monitor in that they spatially mix points of light to produce a wide gamut of colors. This has resulted in an explosion of applications in architectural and entertainment lighting where color now plays a part in building and environment design. General advantages include direct generation of colored light without filters, long life, high efficiency and lower operational costs.

LEDs are viable for all color applications today; they can light up the side of an 11-story building from the ground, they light Broadway sets and provide sufficient output for all but the very highest output fixtures using traditional sources with filters. Just a few years later, exactly the same trends for white light are starting to occur. For accent, decorative and display lighting, white LEDs are already viable, and general illumination sources may be just around the corner.

White LEDs are fast approaching utility as high-quality light sources for illumination. While mixing of colors can produce a white light, it is also

Making White Light

generated by combining a blue LED with a phosphor mix. This is similar, in principle, to the mechanism used by a fluorescent light source to create white light from a UV source. The phosphor absorbs radiation of one frequency and re-emits at another frequency; blue light is transformed into white light. For white LEDs, the challenge for the past several years has been to produce sufficient output to be useful, to produce a good quality white light, and to produce a consistent output from LED to LED and from fixture to fixture. What follows is a look at five specific challenges that will likely affect white LED acceptance and market penetration.

1. Quantity. LEDs continue to improve in output. Each year brings a 35 percent improvement in output. This trend has occurred over 40 years since LEDs were first created in the laboratory. Decades of improvements in materials, tools and processes followed by improvements in manufacturing have resulted in this steady drumbeat of improvements. It shows no sign of slowing. Single LED packages today can produce 30-44 lumens and multi-chip packages have been shown by several manufacturers in the 1000 lumen range. At 800 to 1000 lumens, a very large fraction of traditional lamps are covered. Directed light sources, such as in car headlights, are already being implemented with LEDs.

2. Quality. Early white LEDs were not only dim, but the light output had a pronounced bluish tinge. The light conversion mechanism resulted in light output spectra that had a noticeable blue hump. Improvements in the phosphors have also improved the spectral output. Color temperature selection in white LEDs is steadily moving down into incandescent territory and good quality warm white light LEDs down to 3000K are available. As the color temperature drops, the conversion efficiency also drops, since the conversion leap from blue wavelengths down to red wavelengths becomes greater and more challenging.

3. Color Rendering Index. Quality is a funny metric. How do you measure the "goodness" of a light source? One metric devised to address this issue is Color Rendering Index. CRI compares color appearance viewed under the source to color appearance viewed under a reference illuminant. The CRI scale is from 0-100, where 100 is identical to the illuminant. In general, 70 to 80 CRI is considered good and above 80 is excellent. Differences of five or so are meaningless.

Additionally, two light sources of different color temperatures may have identical CRI but will render colors very differently. You cannot compare the CRI of two light sources at two different color temperatures. Also, a score of 100 does not mean it will render color well in general. Try matching dark blue and black socks under low light incandescent sources.

CRI has known deficiencies and problems; designers often use their hands under a light source to gauge the quality of light rather than simply looking at the numbers. There are multiple efforts worldwide to address issues with CRI, but this will take a few years to resolve and get a consensus. Even with this metric however, white LED sources are already available in the mid to high 80s, sufficient for all but the most demanding applications. The color space used for CRI is non-linear, especially in red, is also obsolete and is used now only for calculating CRI. Several efforts are underway to redefine a quality metric for light sources, but light quality, in the end, must be determined by the user.

Moreover, white light LED outputs can vary across their beam. Color and optical artifacts result in non-uniform intensity and spurious textures. Generally this means that additional diffusers or other means are required to homogenize the output. But visual, non-uniform textures in the output are generally unacceptable.

4. Color Temperature Control. LED selection allows the use of different color temperature LEDs to create fix-

tures that provide color temperature control. This allows the user of a control system to change color temperature and brightness *independently*. When a halogen or incandescent source is dimmed it shifts color temperature towards a warmer color. With an LED system you can not only mimic that but create any sequence of color temperatures. Thus, with such a system you can mimic daylight so there is no transition between interior light and exterior lighting.

5. Consistency. We take for granted that different lamps of the same type and model will produce the same output. LEDs, however, can vary significantly in color, uniformity of output or light output. LEDs can vary significantly due to small variations in the manufacturing process. This manifests itself as aberrant colors. This variation is often referred to as the "binning" or "batching" problem. LED manufacturers sell their LEDs and can supply different bins so that LEDs can be segregated according to color. But binning is not just a color issue. These same manufacturing variations result in variations in intensity and electrical characteristics. Fortunately, these types of variations can be accommodated by good design practice, for the electrical variations and the intensity variations are less noticeable than wavelength or color variations. The three dimensions of color, hue saturation and value (sometimes termed brightness) are also in the order of decreasing sensitivity.

Trends and Applications

LED manufacturers have announced continued improvements in efficiency, output and consistency of white LEDs. These developments have resulted in packages of 50 lumens per watt or more and binning narrow enough to rely on for production purposes. LEDs continue to improve rapidly, and a decades-long trend continues with packaged LED output growing at 35 percent per year while, at the same time, the cost of this device decreases at a rate of around 20 percent per year. This is equivalent to doubling the combination of price and performance every 18-24 months.

As they did when making their earlier assessments of LED technology, many designers and manufacturers appear to be waiting for some magical crossover point at which LEDs will exceed their traditional light source brethren in certain metrics. However, LEDs already possess many advantages over their elderly cousins in lighting and are on the cusp of many applications beyond indication and colored lighting. Price and performance continue to improve in an industry not used to seeing these levels of improvement in traditional light sources. General illumination is rapidly becoming viable both on features and benefits, as well as cost. Quality measures and specifications of CRI, color temperature and efficacy combined with these benefits are resulting in a light source that is compelling for many applications.

White LEDs are ready for low-medium luminance applications, such as display lighting in retail, but general illumination may still be a few years away.

PHOTOS: COURTESY OF COLORKINETICS

These applications, however, are not limited to the mere replacement of conventional sources. LED technology will make it possible to rethink light itself—the way it's produced, controlled and applied. The physical nature of solid-state lighting devices—compact size, lack of radiated heat and lack of moving parts—frees them to be integrated into walls, ceilings, furniture and other structures to create luminous surfaces, for example. Imagine a future where these surfaces become the actual lighting system, and change the very way buildings are designed?

That future could be closer than you think.

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About the Author: Kevin Dowling, PhD, is vice president of strategic technologies for Color Kinetics Inc., a Boston-based provider of intelligent solid-state lighting systems and technologies. He is active in the National Electrical Manufacturers Association (NEMA) Solid-State Lighting Section, which is tasked with integrating solid-state light sources in existing lighting practices and the creation of new practices to fully exploit the technology's potential.

The new two-story glass and steel Entry Pavilion features a segmented tube integrated in the curtain wall that uplights the ceiling, as well as track lighting for special events and exhibitions.

PHOTOS: KEITH CLARK, BDMD ARCHITECTS

STILL GOING STRONG AFTER 120 YEARS, THE VENERABLE INDIANAPOLIS MUSEUM OF ART HAS ADDED THREE NEW WINGS

Spreading Its Wings

In 1883, May Wright Sewall, principal of the Girls' Classical School of Indianapolis, and several other city residents founded what would later become known as the Indianapolis Museum of Art. They believed that life in their young city would be richer if there was a collection of art accessible to the public. That philosophy has endured for over a century; today the museum's permanent collection of art numbers 50,000. But it's not only the art collection that's growing; it's the physical space, as well. Three new wings at the IMA opened in May of this year. The $74 million project added 172,000 sq ft of space, while 120,000 sq ft was renovated.

IMA commissioned architect Browning Day Mullins Dierdorf Architects and lighting designers Fisher Marantz Stone, Inc., to design the new wings, which include a glass oval Entry Pavilion, Gallery Pavilion and Special Events Pavilion. The pavilions are part of a larger $212 million restoration/site improvement plan that dates back to 1998.

The three new wings will make the museum more accessible to the public while giving the site a more unified quality. During concept development, however, several complex problems had to be addressed. They ranged from protecting the collections storage area at all times, general security, protection of select "specimen" trees, working around Sutphin Fountain, building and then transitioning services to a new central plant, and filtering damaging UV rays from daylight. Another challenge was keeping room temperatures at 70 deg Fahrenheit and relative humidity at 50 percent within gallery spaces to maintain the proper condition of artwork. Moreover, the museum officials' requirement to keep IMA's doors open through construction further complicated what was already a daunting project.

Making an Entrance

One of the first goals of site development was to open the museum to the street. This provided a more welcoming view to the visitor, including a direct view to the Lilly Oldfield Gardens, supported by a tree-lined alley leading to the museum structures. As visitors proceed toward the museum, they are met by a redesigned landscape that embraces the existing Sutphin Fountain.

The 16,500 sq ft Efroymson Entry Pavilion—a two-story oval structure of glass, lightweight stainless steel trusses, and a delicate louvered bris soleil—is the starting point for visitors. The Entry Pavilion serves as a transition space from the gardens outside to the display areas within. Its curtain wall-integrated lighting system consists of a segmented tube that provides ambient uplighting of the convex ceiling and track lighting system to provide lighting for special events or sculptural exhibition. The continuous tubular segments of track encircle the perimeter curtain wall and provide 360 deg flexible coverage throughout the pavilion.

The Entry Pavilion is also connected to the new parking garage by a tunnel that is itself embellished along both well-lighted walls by muralist Kay Rosen. The tunnel ceiling features a curving line of elliptical skylights providing natural light along the entry path—and an inviting glow from the plaza at night.

The Gallery Pavilion

The second of the three new structures is the Wood Gallery Pavilion. Where visitors were once met by an imposing and often intimidating set of steps, the Wood Gallery Pavilion now provides a more pleasing experience. Some 44,000 sq ft of gallery space (a 50 percent increase to the museum's display space) has been added on three levels, including a permanent gallery for traveling exhibits. As was the case in the Entry Pavilion, an integrated track lighting system

Above, a curving line of elliptical skylights run along the path leading to the Entry Pavilion. These lights also illuminate a tunnel connecting the Entry Pavilion and a new parking garage.

The Deer-Zink Pavilion includes a convex curved wood ceiling uplighted by clerestory windows and supplemental fluorescent lighting to create a soft glow.

allows for a completely flexible arrangement of fixtures that can light art and sculpture throughout the spaces.

The New Pulliam Hall (also known as Heron Hall) connects the Entry Pavilion and Wood Gallery Pavilion. It serves as the focal juncture of the new and old galleries. With its adjoining balconies and central atrium circular skylight, it sets the stage for illuminating works of art from conventional heights of 12 to 14 ft up to the soaring 54 ft. New and renovated space of approximately 36,100 sq ft was designated for collection support and education. These areas include exhibit design, photography, state-of-the-art storage for prints, drawings and photographs, the reference library and an educational resource center. Also new is an education suite, including four art labs, two lecture rooms, a lunchroom and studio for distance learning.

The Gallery building also houses two new restaurants: Puck's—a fine dining eatery from Wolfgang Puck—and a neighboring café. A half-wall separates the restaurants, with the café set slightly above grade to the restaurant. Dining room lighting was conceived to uplight rich wood ceilings and provides focal glow for special events. The dining area especially sparkles at night and features large glowing pendant fixtures that can be seen from across the landscape. Puck's overlooks the Sutphin Garden and Fountain and will offer public dining three nights a week after museum hours. The remaining four nights will allow for private parties and gatherings.

Another challenge was keeping room temperatures at 70 deg Fahrenheit and relative humidity at 50 percent within gallery spaces to maintain the proper condition of artwork

The café in the Gallery Pavilion sparkles at night due to large glowing pendant fixtures, visible from across the garden areas.

The site is now open to the street; the tree-lined alley provides an attractive welcoming view for visitors.

Special Events Pavilion

The new Deer-Zink Events Pavilion, located on the north side of the Sutphin Garden and Fountain, is the third structural piece in the IMA design. It hosts both public and private events and houses a banquet facility with capacity for 500 guests. This facility can now allow large-scale events to take place on museum grounds without disturbing normal museum operations. A richly detailed convex curved wood ceiling is uplighted by clerestory windows and supplemental fluorescent lighting to create a soft glow. A necklace of sparkling fixtures creates a chandelier-like presence in the center of the pavilion, highlighting the oculus skylight.

At IMA, good things—and renovation—come in threes.

About the Designers: Charles G. Stone II, LC, Member IESNA (1991), IALD, is president of Fisher Marantz Stone. He received a Bachelor of Arts degree from Princeton University with a Certificate from the Program in Theater and Dance for Lighting Design. Since joining FMS in 1983, Mr. Stone has designed projects including concert halls, airports, convention centers, museums, hotels, theme parks, corporate headquarters, commercial developments and residences. He has received numerous IALD and IESNA awards for projects such as the American Museum of Natural History, the Korea Development Bank, Hong Kong Airport and most recently "Postcards"—the September 11 Memorial. Mr. Stone is a member of the European Lighting Designers Association and is 2004-2005 president of the International Association of Lighting Designers.

Jonathan R. Hess, AIA, has been with Browning Day Mullins Dierdorf Architects since 1984. A graduate of the University of Illinois, Urbana/-Champaign, he specializes in projects ranging from museums, to educational facilities, offices and houses of worship.

PROJECT

PHOTOS: MAURICE BRILL LIGHTING DESIGN, 2005

WORTH THE Wait

LIGHTING CREATES DAY/NIGHT DRAMA AT THE PARK HYATT ZURICH, THE CITY'S FIRST LUXURY HOTEL IN 20 YEARS

Been there, done that? Whether for business, or pleasure, most travellers have probably frequented one of the Hyatt's 213 hotels in 43 countries. One of the latest newcomers to the hotel chain's stable is the Park Hyatt Zurich in Switzerland.

Located in the heart of city's financial and commercial district, the hotel is within walking distance of Bahnhofstrasse (a fashionable shopping street), the Zurich Kongresshaus (convention and exhibition hall) a local lake and the town of Altstadt. Completed in 2004, the Park Hyatt Zurich is more than a 142-room (12 suites) residential-style hotel. Additional features include a restaurant, bar, lounge, health club with a gym and 12 meeting rooms, the largest of which can accommodate 300 visitors for both meetings and social gatherings.

The hotel's architecture features an ultra-modern steel-glass design by Meili Peter Architekten AG, Zurich, while the interior design concept was created by HBA, Hirsch, Bedner Associates, Atlanta, GA. London lighting consultants, Maurice Brill Lighting Design (MBLD), were called upon to create a strong and clear lighting concept that needed to support the interior design concept and ultimately work in a seamless way throughout all of the public areas. "With the majority of the interior spaces fitted with polished blackberry granite floors, offset by white or cream leather and timber wall panels, the main challenge was to create a controlled dramatic atmosphere at a local level, but still create a soft understated awareness of the large interior volumes," said senior associ-

The bamboos are uplit for the evening from within by 20-W MR16 floor recessed uplights, which form a subtle backdrop for the evening lighting scenes.

Selected walls within the reception and lounge areas are covered by full-height soft white sheers, which create an opportunity to introduce soft diffused ambient light while framing an alluring backdrop.

ate, Robert Honeywill. MBLD's scope of work included the lighting layout for the reception area, bamboo garden, lobby lounge, Parkhuus restaurant, Onyx bar, health club, ballroom and meeting rooms.

Right This Way

Creating a sense of arrival and quickly revealing the direction to the reception area was an important element. Upon entry, clusters of three, 50-W 24 deg Delta Light downlights are used to form parallel stripes of light on the floor that encourage guests towards the reception area, and the light reflected from the dark granite floor pattern is cast up onto the ceiling. "One of the first decisions before putting pen to paper was to keep the number of downlights to an absolute minimum, keep the ceilings as uncluttered as possible and retain a minimalist philosophy throughout all the spaces," said Honeywill.

Once inside the reception area, the ceiling soars to three stories, which on one side allows a stream of natural daylight to penetrate reception and lounge space. The reception space also features a rectangular bamboo centrepiece that allows the space to be masked against the lounge areas. The bamboos are uplit for the evening from within by 20-W MR16 floor recessed uplights, which form a subtle backdrop for the evening lighting scenes. The floor area around the bamboo and in front of the reception and lounge are mounted with 500-W downlights that are set within a custom square housing that keeps within the family of fixtures.

Selected walls within the reception and lounge areas are covered by full-height soft white sheers, which created an opportunity to introduce soft diffused ambient light while at the same time framing and creating an alluring backdrop. Single lamp 100-W downlights are used to backlight the shears, which

Multiple downlights allow light to be carefully focused in the direction of the dining tables, while copper wire mesh pendants are suspended overhead.

(three for the lounge area) are dimmed at low levels for the evening lighting scenes, but for the morning breakfast scene are run at 95 percent to create a brighter, energetic scene.

Honeywill said, "The majority of the hotel's spaces are multi-functional and are used differently morning, noon and night, and the lighting has to be able to accommodate these uses. Nearly all areas receive good daylight penetration, and we knew we had to create spaces that had a completely different feeling at night than the day." A Lutron lighting control system was used throughout, and the dimming and balance of all the public areas were set at a low-level to tie into the intimate and sophisticated atmosphere.

The connecting corridor between the lobby and the bar and restaurant is lighted asymmetrically. Floor recessed uplights mounted closely to the wall form a band of light on the ceiling, while multiple (three lamps in a line formation) 50-W downlights mounted off center create pools of light that direct guests past the bar and up to the restaurant. (Kreon supplied all the uplights and downlights for this portion of the project.)

'Nearly all areas receive good daylight penetration, and we knew we had to create spaces that had a completely different feeling at night than the day'

Service Concept

The bold and vibrant mood inside the Parkhuus restaurant is created by the centerpiece show kitchen and a two-story wine library that holds over 3000 bottles. Multiple downlights (four lamps in a square formation) allow light to be carefully focused in the direction of the dining tables, while copper wire mesh pendants are suspended overhead. The wine tasting room uses integrated fiber optics within the cabinet and a classic Ingo Maurer ceramic pendant "Porca Miseria!" creates a focal point.

Adjacent to the 135-seat restaurant and separated by iridescent copper mesh glass panels is the chic

Adjacent to the restaurant and separated by iridescent copper mesh glass panels is the chic Onyx bar.

All of the artwork is selectively lighted from ceiling recessed directional downlights that provide splashes of color.

Onyx bar. Named after the onyx stone that runs throughout, the venue also features floor-to-ceiling glass walls that provide a view of the restaurant's summer terrace. In the evening, the panels slide back to expose the bar, and the sounds of live music and dancing can scatter into the streets once the exterior windows are lifted. The glass bar wall was originally conceived to give a cold appearance using dimmed 4000K T5 fluorescent OSRAM SYLVANIA lamps as the backdrop to cold vodka bottles. Honeywill said that this was altered during the commissioning to incorporate CT color filters, so a warmer appearance could be achieved from within and seen from the street entrance. Subtle touches of light from recessed single lamp MR16 downlights and internally lit alabaster tables and bar counters, combined with the backlit bar, come together to establish an intimate ambience.

The banquet and meeting rooms cover more than 3000 sq ft for seminars, banquets and private events. The banqueting room is divisible into three soundproofed rooms and uses a combination of 250-W tungsten halogen (Erco) downlights for ambient lighting together with coffer mounted, concealed, white cold cathode for the daytime functions and a midnight blue cold cathode for the evening functions. Facility illumination is also provided by ceiling recessed skyhooks. The Enlighten UK skyhooks have the advantage that when not in use, the only visible aspect is a square plate on the ceiling. However, when in use, vertical lighting bars drop down from the ceiling, and provide access to theater equipment and DMX controls.

The pre-function area immediately outside the ballroom is almost 30 ft high and in order for designers to create a dramatic impact on the dark granite floor, they chose to use a single 500-W downlight to create a grand and dramatic statement. The ballroom wall was highlighted with narrow beam downlights together with the entrance doors. As with the lobby corridor, the pre-function corridor sets up a key view optimized by select pieces of inspiring artwork by artists such as Sol Lewitt. All of the artwork is selectively lighted from ceiling recessed directional downlights that provide splashes of vibrant color.

—John-Michael Kobes

About the Designers: As senior associate, Robert Honeywill has been an architectural lighting designer at MBLD for over 18 years. His project experience has included worldwide five star hotel developments, as well as commercial and retail sector designs, urban masterplans, and work for British Airways, Hyatt International, Gap and University College London.

Maurice Brill, Member IESNA (1989), is the founder and creative director of MBLD. Throughout his early career in the theater, he designed for companies such as the Ballet Rambert. He later formed one of the UK's first independent architectural lighting design companies.

Luraline's Vanguard series of vapor-tight lighting fixtures is ideal for industrial styled interiors and exterior settings requiring extra protection, such as the parking lots and walkways of retail applications. Suitable for use in wet locations, all models are fully gasketted to seal against moisture and exposure to the elements, including dust, fumes and insects. The series is available in pendant, ceiling and wall-mount configurations, with choice of incandescent, compact fluorescent or H.I.D. lamping.

www.luraline.com

At 2 7/8th in. in diameter, **Lightolier**'s three-inch family of MR16 recessed luminaires offers the smallest aperture available with specification-grade performance and glare control. Like all Calculite Evolution products, the three-inch offers a complete palette of interchangeable optical assemblies providing the power and flexibility to enrich virtually any commercial or residential environment.

www.lightolier.com

CPS Corporation offers Aluminum Silicon Carbide (AlSiC), a metal matrix composite ideally suited for thermal management solutions for high brightness LEDs. AlSiC enables a tailored Coefficient of Thermal Expansion (CTE), offering compatibility with various electronic devices and assemblies. Unlike traditional housing materials, the isotropic CTE value of AlSiC can be adjusted for specific applications by modifying the Al-metal/SiC-particulate ratio.

www.alsic.com

Day-Brite Lighting's Lumalier family of in-room air UV-C disinfecting products utilize UV-C irradiating lamp technology to kill up to 99.9 percent of airborne bacteria and reduce airborne transmission of influenza, colds and viruses.

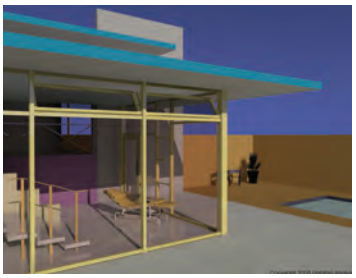
www.daybritelighting.com

Lighting Control and Design's Intelligent Thermostat can be locally and remotely accessed, program and monitor up to 32 thermostats, via dial-up or internet, including set back-times and temps, local keypad adjustment range, and more. Combine lighting and thermostat controls into one digital, easy to use energy management solution and at about 80 percent less than traditional EMS packages.

www.lightingcontrols.com

Lighting Services Inc's fiber optic harness is made from the highest quality glass illumination grade fiber available to ensure high-performance lighting as well as years of maintenance-free illumination. Constructed of extremely flexible glass, the fiber optic harnesses are available with either 14 or 24 individual tails that are each 10 ft long.

www.lightingservicesinc.com



Version 1.8 of **AGI32** lighting design and rendering software is a major enhancement that includes more powerful page layout capability, XP-style file management system, interactive render-mode walk command, absolute zenith luminance daylight calibration and tone-mapping compression for ray-traced images. The sample rendering demonstrates how AGI32 enables the designer to show how daylight will affect a space at any time of the day.

www.agi32.com

The Sivoia QED roller 64 system from **Lutron Electronics** incorporates all of the same features and benefits of Lutron's Sivoia QED system, but in a significantly smaller profile, allowing it to be housed in smaller window jambs and pockets. In comparison, Sivoia QED roller 100 controls up to 100 sq ft of fabric, while Sivoia QED roller 225 controls up to 225 sq ft of fabric. The new Sivoia QED roller 64 controls up to 64 sq ft of fabric.

www.lutron.com

Venture Lighting's MP 875-W Uni-Form pulse start lamp provides energy savings, longer life and significantly more light over time than today's standard 1000 watt metal halide system. The lamp has a high lumen output of 95,000 lumens, mean lumens of 76,000 and a rated life of 20,000+ hours, indicating that 70 percent of the lamps will still be operating at end of rated life.

www.venturelighting.com

The GlassChromia from **Imaging Sciences** offers a patterned chrome look in decorative glass and is part of the Imagine Glass product line. The glass utilizes a decorative interlayer laminated between two or more pieces of glass, creating decorative architectural safety glass. Fine resolution and artistic detail can now be incorporated into any window, surface or other glass construction where a reflective surface is desired.

www.imaging-sciences.com

Juno Lighting's ModuLight emergency lighting system provides one- or two-lamp T8 operation, 1100 to 1400 lumens and 90 minutes of operation time. A power-delivery lighting system that can reduce installation costs by 20 to 40 percent, ModuLight's power converter is mounted separately from the lighting fixture, eliminating the need for electrical components like conduits, wiring and J-boxes.

www.junolightinggroup.com

Cotco's half-watt Mini Dorado LED is ideal for compact lighting situations where reliability and high illumination are essential. Architects, manufacturers and designers can use the LED for a wide variety of applications in areas such as automotive and traffic lighting, interior and exterior architecture design, entertainment, decorative and landscape lighting. The Mini Dorado will also be utilized in PDAs and other hand-held devices that demand brighter, higher power displays.

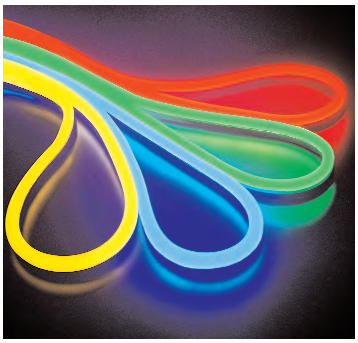
www.cotco.com

Combining a sleek, compact design with new lamp technology, **Amerlux** unveils the Imperia Vertical track luminaire for accent and display lighting applications. Engineered with high performance optics, specially designed for the new 20-W Philips Mini MasterColor CDM-Tm ceramic metal halide lamp, available in spot, narrow flood, flood and linear spread distributions, the Imperia Vertical provides a cost-efficient alternative to fixtures using low and line voltage halogen lamps up to 100 watts.

www.amerlux.com

Leviton's ceramic lampholder is designed for single-ended metal halide lamps with a G8.5 base. The lampholder features a lead-in edge that helps ensure proper lamping and reduces the incidence of broken lamp pins. Solid nickel contacts are spring-loaded to ensure superior electrical continuity. Other quality features include threaded bushings for secure mounting and high-temperature 250 deg leads.

www.leviton.com



The LED-FLEX LED lighting system from **Mule Lighting**, has the same appearance as traditional neon lighting, but requires less energy, is more flexible and durable, and can be used in many applications where neon is not appropriate. LED-FLEX contains no harmful gases, making it safe to handle, and can be custom cut and shaped on-site, without the need for specially trained personnel.

www.mulelighting.com

Addressing the need for more flexible LED displays, PopVision a portable, self-contained LED video screen features **Lighthouse**'s proprietary technology, enabling a high-resolution screen with better quality images at an affordable price. Designed for aesthetic integration, PopVision–with brightness level up to 3000 nit–is an option choice for any digital signage network (new or existing) where LCD, Plasma and projection systems are not appropriate. The six mm screen is contained in a five ft by two ft mobile case with a wireless remote and hydraulic system that enables the display to "pop up" for fast, simple set-up.

www.lighthouse-tech.com

Attractive and colorful, the winter garden from **Fiberoptic Lighting** adds to the aesthetics of wherever they are installed. With its unique color wheel, the winter garden changes colors from pale spring to more powerful summer to the golds of fall and finally looks like snow has fallen.

www.flisign.com